THE CHEMIST

JULY 1952 VOLUME XXIX No. 7

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AIC President-Elect

(See Page 303)

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COVER PICTURE

Dr. Donald B. Keyes, F.A.I.C., new president-elect of THE AMERICAN INSTITUTE OF CHEMISTS, is special consultant to the Heyden Chemical Corporation, New York, N. Y., and a member of the staff of the National Association of Manufacturers in an advisory capacity to the Association's Committee on Research.

From 1945 to 1950, Dr. Keyes was a vice-president of Heyden Chemical Corporation, and then became special consultant. From 1926 to 1945, he was professor of chemical engineering and head of the Chemical Engineering Division of the University of Illinois. However, he was on leave from the University from 1941 to 1945, to work with various war agencies in Washington, D. C. His final year there was spent as director of the Office of Production Research and Development. Previous to 1926, Dr. Keyes was chemical engineer with Beckman and Linden Engineering Corporation, San Francisco, and with U. S. Industrial Chemicals, Baltimore.

Dr. Keyes received the B.S. degree from the University of New Hampshire, the M.A. from Columbia University, and the Ph.D. from the University of California. Honorary doctorates were conferred on him by the University of New Hampshire and Stevens Institute of Technology. He received the 1945 Honor Scroll of the Chicago AIC Chapter for outstanding contributions to chemical engineering, and the 1949 Honor Award of the New York AIC Chapter for "his service and devotion to young chemists."

AIC members have elected him, several times, to the National AIC Council, and he has served faithfully on various committees, where his wide experience and background of professional activities in many societies have prepared him to advise and carry out successful programs.

ANNUAL MEETING PAPERS

Papers presented at Session C, on "The Situation in Chemical Literature," Session D, "Employer-Employee Relations," Session E, "Industrial Safety and Hygiene," the Honor Recipients' Luncheon, "Rewards and Responsibilities," and the General Session, "Chemical Research—Management Viewpoint," will appear in the August and following issues of THE CHEMIST. These papers by experienced scientists, which continue the series of profitable professional articles published monthly in THE CHEMIST, should be read carefully by every career-minded chemist.

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The Chemist and His Profession

Dr. H. B. Hass, F.A.I.C.

President, The Sugar Research Foundation, Inc., 52 Wall Street, New York 5, New York

(Presented at the AIC Annual Meeting, May 7th, as part of Concurrent Session B, "Public Relations for the Chemist.")

I SHALL use the term "public relations" in the very broadest sense. It includes all human relationships outside of one's own family and intimate circle of friends.

Public relations is not essentially a job which can be delegated to an expert with the title, "Manager of Public Relations." It is a question which includes everything that all of us chemists do to and with and for and against one another and our non-chemist friends, enemies, and acquaintances. It is a matter of whether we are polite to our secretary when things don't go well. It involves how we act toward the grocer when the grapefruit is spoiled and how we drive our cars in traffic.

Public relations belongs in the broad category of ethics. One of the best public relations men I have ever known told me not long ago, "Our company will succeed in public relations only when all of you cease to think of it as my job and realize that it is the job of every man in the company every minute of every day. I can do a little smoothing over of bad situations. It would be far better if they had not developed. I can present facts in their most favorable light. It would be more desirable if the facts were such as to require no apologies."

I find it somewhat remarkable that a group of important scientists should be willing to devote an afternoon to discussion of ethics — remarkable and admirable. We should begin by pointing out that in ethics there is much that is traceable to one's background and early training. There is no reason to expect such general agreement as one finds in science; much depends upon one's tastes and personality.

Then what do we mean by a profession? A profession is an occupation in which one ministers to the public by the use of superior specialized knowledge. We note two criteria. The first is ministering to the public and here we encounter a division of opinion among chemists. One group feels that only the self-employed chemist is truly professional. It is only the consultant, they assert, who meets this criterion. The rest are sub-professional wage-slaves.

"Not so," says the chemist employed by a company. "We serve the public indirectly. We have given the public nylon and terramycin and chloromycetin and a thousand other

triumphs of chemistry which make life safer and more comfortable."

Now words mean what we agree that they shall mean by the common usage of educated persons. We have in America nothing corresponding to the *Academie Francaise* which dictates good usage. Since consultants are a small minority of chemists they will always be outvoted on this question and for the forseeable future we must include chemists as professionals whether they serve the public directly or indirectly.

As for the second criterion, the "use of superior specialized knowledge," there can be no reasonable doubt. One of the principal reasons for the shortage of chemists is that chemistry is a difficult subject and only a relatively small percentage in any population has the combination of intelligence and persistence required to master it.

What are the principal problems in the public relations of a chemist with his profession? There are several ways of approaching this problem but I have chosen first to discover whether there is any well-recognized personality profile which more or less fits the typical chemist and then to proceed from there to postulate the sorts of strengths and weaknesses which would be expected to be experienced in the professional relations of such a person.

Fortunately psychologists have done some work on what kind of a person a chemist is. Lin Yu Tang says that psychologists amaze him in two ways, first by the things which they prove which are so obvious that everyone already knew them, and second by the things they don't prove which you know perfectly well are true even though the psychologist can't seem to devise the techniques capable of showing them to exist. Those of us who are more scientific and less intuitive, however, feel reassured when statistical analysis confirms what we thought we knew.

The Chemist Characterized

What kind of a person is a chemist? It is unnecessary to point out that chemists are people and that people vary from one another. We learned about Maxwell's distribution law when we studied the kinetic theory of gases. There are, however, definite ways in which chemists vary from the average citizen to a degree which is of importance.

In the first place, chemists are well above the average in intelligence. They rate definitely above executives, for instance. There are in the United States more than a million adults who fail when asked to construct a sentence using the words: Boy, ball, river. None is a chemist.

The chemist has far more than his share of curiosity. He is in most instances far above the average in creativeness. He has gone to school much longer than the average. He has developed in some degree the charac-

ter trait of departing from the conventional; you will find more chemists than lawyers going without hats in summer; though still fewer artists and writers will wear hats in summer. Chemists and other scientists place a greater emphasis upon intellectual honesty than most people do. They are more willing to keep on learning and to accept change than others of their own age and they are more international in their outlook than the average citizen is. They are only fair in ability to communicate ideas. With numerous outstanding exceptions, chemists are more introverted than the average person.

"Well," you say, "I knew that all along." Good! But now we are reasonably sure that these are real facts and not just doubtful impressions.

Suppose, now, we use just a little of the imagination implied by the word "creativeness," which we have just applied to chemists, and visualize what sort of professional relations would be expected of a man or woman with the personality profile just sketched. It will be expected that from your wealth of experience you will confirm, modify or deny the reality of this picture of our profession.

How Should the Chemist Act

What would we expect of the professional relations of a chemist which derives from high intelligence? Well, for one thing, he has to be very careful to avoid offending others by giving the appearance of a feeling of mental superiority. One of the most disruptive influences in a laboratory is a certain type of intellectual snobbery. This can be a real handicap to a chemist in several ways. He may antagonize the plant workmen who can express their feelings by failing to cooperate. He may reject good suggestions from others with less education. He may be hard to handle because he is more intelligent than the executives who are above him in the organization chart but not quite intelligent enough to know that in any organization the power to direct must accompany the responsibility for results.

Three years ago the non-technical president of a large chemical company suggested an example of a problem of transcendent practical importance. He urged the development of a practical and economical process for obtaining fresh water from ocean water. From the remarks of certain Ph.D. chemists one would have supposed that the idea had no prospect whatever of success. Since the recent announcement of a new electrical method of doing exactly what was suggested, the chemists have refrained from discussing this point, but I have no doubt that they will be just as certain next time that only a chemist can imagine what a chemist should do research on. Now this is most unfortunate. Chemists are the only people who can solve chemical prob-

lems but anyone can propose a good research subject. In fact, good subjects for research are more likely to come from a non-chemist than from a chemist, for the same reason that white sheep eat more than black sheep. There are more of them.

The chemist is a naturally curious person with an undying zeal to know more and more about the universe around him. Conversely, he is usually more than willing to help satisfy the curiosity of others by presenting the more interesting and important of his own discoveries. One of the greatest incentives for doing research is the acquisition of a greater understanding of how, and even to some extent why, the phenomena of nature are as they are.

Even this laudable impulse may lead to difficulty. We have all seen chemists become so engrossed in a fascinating scientific problem that they kept on working long after the economic justification for the effort had disappeared. It is remarkable to hear the strange and spurious reasons advanced for keeping on long after its utter folly from a practical standpoint should be apparent. We chemists should never try to suppress curiosity; it is one of our most important emotional drives. But emotions, even the best ones, need to be controlled.

The chemist is creative; some much more than others. Until recently it has been customary to contrast the analytical chemist who merely discovers what is there from the creative organic chemist who produces molecules which, so far as we know, never before existed. This distinction should be largely abandoned in view of the amazing series of electronic and other devices which have been invented and developed by the modern analytical chemist. In all fairness we organickers should honor the men who tell us whether or not we are on the track we hope to be on and who are exhibiting the most amazing ingenuity in doing so.

It is, I think, typical of creative people that they can be led but not usually driven, that they are somewhat temperamental, impatient of restraints and unwilling to punch time clocks. They are in some degree often emotionally immature. This may easily be overemphasized but if we try to remember that chemists are in some respects more like artists and writers than they are like the conventional stereotype of a scientist—a sub-human, unemotional, grinder-out of data—we may save ourselves disappointments.

The chemist not only is highly educated in a formal way but he must keep on learning continually if he is to reach and maintain maximum usefulness. I shall never forget a certain luncheon address by one of the Grand Old Men of American Chemistry, Prof. E. Emmet Reid, Hon. A.I.C. He said, "During most of my life I have tried to become an organic

chemist. And now the literature with which I am totally unfamiliar is ten times as large as it was when I started!"

We have all had the experience of seeing a difficult problem yield to a thought made possible by just one additional fact. Do you remember the story of the consultant who was confronted with a reference which mentioned a solution of cellulose nitrate in ether? Cellulose nitrate will not dissolve in ethyl ether. But the U.S.P. ether at the time of the reference contained alcohol and ether. A little additional knowledge solved the problem.

Yet there is a hazard here also. Creative thought seems to depend upon arranging ideas into new patterns. It can happen only if the ideas are in the same mind at the same time. But too great a preoccupation with the acquisition of ideas is detrimental to the proper attention to the rearrangement of the ideas. We need balance here.

It is also possible to achieve creative sterility by knowing too many things which won't work and hence are never tried. I have listened to many exasperated research directors who complained about chemists being unwilling to try something which has been given a half-hearted attempt and from then on is left severely alone. I keep wondering how Reppe chemistry could have got started in a modern laboratory where all the chemists would know (1) that a vinyl chlorine would not react metathetically with sodium alkoxide and (2) that acetylene would explode if it is heated under pressure. It was only because Reppe did not know the first of the above statements that he learned that the explosions could be suppressed. In certain circumstances ignorance can be a precious asset.

The chemist is unconventional about minor things. In general I'm all for it. It would be a stuffy world if we all dressed exactly alike and had the same interests and hobbies. The most boring person in the world is the fellow who has read *How to Win Friends and Influence People* and believes every word of it.

A really valuable chemist is a person who has learned to think for himself and is proud of it. Human relations are smoothest in general with people who have the same outlook and prejudices—however irrational and foolish they may be. This is why marriages between persons with similar backgrounds succeed more frequently than the other kind. But a person who is continually getting new ideas and who has learned by experience that many of his original ideas are sound will not for long fit into any conventional pattern. The dissenter is by nature a hard person to get along with and yet, if we want progress in science and invention, or even philosophy and religion, we must have dissenters. Research direction is

such a difficult art because it involves getting teamwork from individualists without crushing their originality.

Yet when a chemist goes into an employment interview without a tie and dressed sloppily, he hurts himself and does little to enhance the reputation of the profession. In some degree we must regard the opinions of others even when they seem irrational.

Honesty in Human Relations

I should like to mention another obstacle to good human relations of chemists. In science we learn by observation and experiment only to the extent that we are intellectually honest. If the molecules insist on behaving contrary to the predictions of our fondest concepts, we are willing to embark on another hypothesis. It is no accident that "graphite chemistry" is almost completely confined to the early undergraduate years. I believe that the effect of research on the character and personality of the researcher would constitute a fascinating area for psychological study. Among all of the diversified people who become scientists their essential honesty seems to stand out as the one trait which almost all of them have in common.

For this reason we are unusually severe in our attitudes toward anyone whom we think is guilty of even a slight distortion of the truth. We are keenly distressed if anything which we publish does not stand up under the critical scrutiny of repetition in another laboratory.

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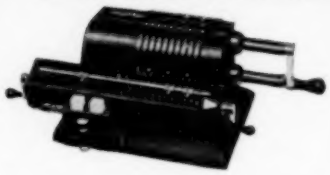
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Now all this is to the good and I would not want to change it if I could. It leads to a problem, however. Human relations, as they have developed in our civilization, are to a large degree insincere. We are so accustomed to this that we hardly realize it.

Many of us have seen the play "Nothing but the Truth," which has been a comedy hit for some decades. The plot revolves around a $10,000 bet that a man could tell the truth for twenty-four hours without evading a question. He won the bet but almost lost his girl, nearly broke up his boss' home and created havoc

generally. When the bet was over, a few skillfully placed lies, reinforced by a tremendous reputation for honesty acquired during the preceding twenty-four hours, restored everything to a peaceful *status quo*.

Ambrose Bierce defined a bore as "A person who talks when you wish him to listen." It is not likely that *everything* which we hear at this convention will be interesting to any of us, but each of us will disguise that fact with whatever skill we have for dissembling. When we listen to the organ recital of an acquaintance just home from the hospital, it may be that we really don't give a dam but we try our best to express sympathy. (A dam is a former unit of Indian currency worth 1/40 of a rupee or slightly less than one cent.)

What I am suggesting is that the exacting emphasis upon honesty, which is the necessary and desirable attribute of every scientist whom we respect, at the same time creates problems in human relations. We have to learn to tread the narrow line where tact and honesty meet.

The chemist is more international in his outlook than the average citizen is. This is in part the effect of intelligence and education and in part the result of learning to admire the scientific contributions of other countries. Chemistry is one of three truly international languages, the others being mathematics and music. An international congress of chemists cooperates enthusiastically when our diplomatic counterparts are completely stymied. Bierce's definition of peace as "In international affairs a period of cheating between two periods of fighting" does not apply to chemists.

Yet not even scientists are wholly free from national, racial, and religious bias. There is room for improvement here and a wise research director will recognize the importance of unjust discrimination even when he uses what influence he may have to oppose it.

Communication

One of the elements of public relations is communication. Here the chemist rates only fair, well below where one might expect from his general intelligence. It is a chronic complaint among industrial chemists that our young Ph.D's who come out of college cannot write an acceptable report. Let us grant that some of this criticism is unjustified and means only that the particular prejudices of the research director have been offended. Grant also that sometimes the young chemist is too ignorant of the background and ramifications of the problem to write a good report, however skilled he may be in written English. Make all the allowances you can and there is still a hard residue of fact. The attitude: "Us engineers don't need no English" is only half a joke and extends to chemists.

"Mique" Flett has pointed out that

the science of chemistry grows steadily more complicated while the number of years devoted to its study remains constant. It might also be pointed out that because of differential fecundity among various groups in our population, the average I.Q. in America is believed to be decreasing by about one point in ten years. Thus while chemistry becomes more difficult, the average student is no brighter and the human relations aspect of a chemical career are increasing in importance.

The remedy usually suggested for poor report writing—more courses in English in school—should at least be seriously questioned. The average English instructor could not write an acceptable scientific report and would not be interested in doing so if he could. The typical student has been learning English in and out of school for twenty-two years when he obtains his first degree and has virtually reached an equilibrium where he forgets what a gerund is while he is being taught that he either (1) should not or (2) may use a split infinitive depending upon who is speaking.

It is still more futile to expect that the study of foreign language will be of great help. So the young chemist can say, "This is the cat of my aunt" in French! He still can't write that report.

The way to learn report writing is, curiously, to write reports. If all of us industrial chemists insisted on good, frequent research reports on fellowships which we administer, the relative neglect of scientific writing would be significantly ameliorated and the students' research would benefit from the compulsory periodic review.

Chemists as Introverts

Finally, chemists are introverts. A discipline as difficult and exacting as chemistry inevitably attracts a disproportionate number of persons who possess the primary personality trait of being "withdrawn" rather than "participating." I am using the terms in the sense of Dr. Raymond B. Cattell, who has made an elaborate statistical study of personality. I have confidence in his scientific approach although I have not time to explain it fully.

It should be pointed out at once that not all chemists, by any means, are of the withdrawn, introverted type. Most of us, for example, are acquainted with such men as Walter Murphy, Marsten Bogert, Raymond Kirk, and Herman Mark, to mention just a few of the opposite kind of chemists.

What is of importance is that youngsters who are not unusually successful in their human contacts, who don't like people or don't handle people well make up for this lack by studying hard in school and excelling in such subjects as mathematics, physics, and chemistry.

Now this is a very desirable phenomenon for the individual who may not be president of his class but becomes the valedictorian. It is also a fortunate thing for the profession and for the general public. Otherwise we could not recruit nearly enough chemists; there are not enough Murphy's, Bogert's, Kirk's and Mark's to go around.

At the same time we should be willing to admit that chemists as a group can benefit to an unusual degree from conscious efforts to improve in the direction of public relations in which we are, on the average, somewhat weak.

This constitutes, as I conceive it, one of the most important reasons for the existence of THE AMERICAN INSTITUTE OF CHEMISTS.

While chemistry has for years held a fascination for the introvert, a continually higher proportion of the simple problems pass into the "solved" category. More and more of our research now deals with subjects which can be attacked efficiently only by the team approach. Never before have public relations been so vital to the chemist, and this aspect of our professional life seems certain to increase in importance in the forseeable future.

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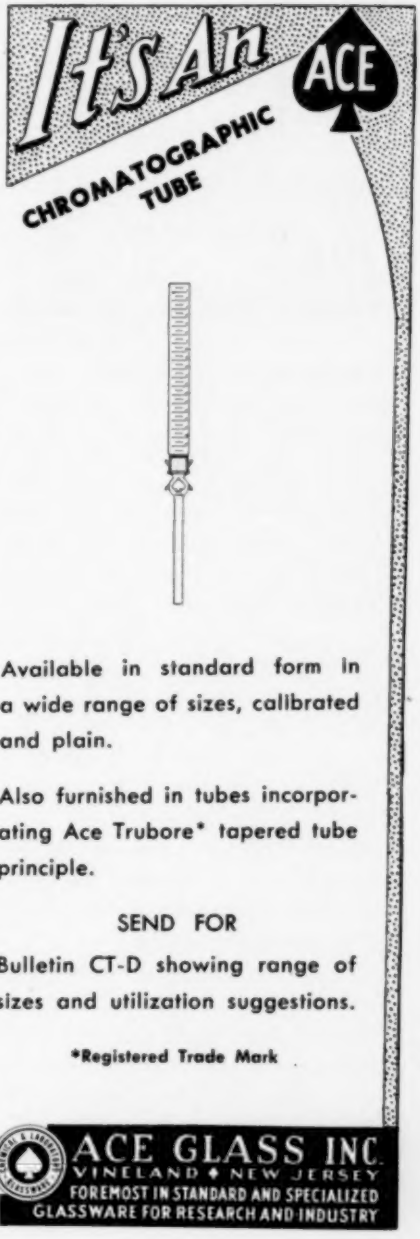
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Speakers: At the annual meeting of the Commercial Chemical Development Association in New York, N. Y., included Dr. Donald B. Keyes, AIC President-elect, chairman of the meeting; Robert B. Semple, F.A.I.C., president, Wyandotte Chemicals Corporation, "Some Reasons for Orientating Development with Research in One Area of Responsibility"; Kenneth H. Klipstein, F.A.I.C., National Production Authority, "The Chemical Industry—Producer of Synthetic Resources"; Dr. W. H. Bowman, F.A.I.C., vice president, Jefferson Chemical Company, moderator of the panel discussion on "What is Being Done with Organized Chemical Development"; Dr. L. P. Moore, F.A.I.C., director, Technical Service and Development, American Cyanamid Company, James G. Park, F.A.I.C., vice president, Enjay Company, Inc., and Dr. R. L. Bateman, F.A.I.C., manager, Fine Chemicals Carbide & Carbon Chemical Division, Union Carbide and Carbon Corporation.

Elections: By the Industrial Research Institute, Inc., New York, N. Y.; president, Dr. Fred Olsen, vice-president for research and development of Olin Industries, Inc., East Alton, Ill.; vice president, Allen Abrams, vice-president, Marathon Corporation, Rothschild, Wis.; and secretary-treasurer (re-elected), C. G. Worthington. New members of the Institute board are Dr. L. B. Hitchcock, F.A.I.C., president, National Dairy Research Laboratories, Oakdale, Long Island, N. Y.; and H. G. Vesper, president, California Research Corporation, San Francisco, Calif.

Purchased: By Archer-Daniels-Midland Company, Minneapolis 2, Minn., the Keystone Chemurgic Corporation, Bethlehem, Pa., and Chlorophyll, Inc. Keystone is one of the largest producers of chlorophyll and xanthophyll. This marks the entrance of Archer-Daniels-Midland into the chlorophyll and xanthophyll industry.

Moved: The New York offices of Balassa Research Laboratories to 110 West 40th St., New York 17, N. Y. Headquarters now at West Barrington, Rhode Island, will be changed on August first to 47 Laurel Way, Madison, N. J.

Changed: The date of the Annual Meeting for 1953, by the American Society for Testing Materials, from June 22-26th to June 29-July 3rd.

Community Relations of Chemical Industry

D. H. Killeffer, F.A.I.C.

Consultant, 168 Westchester Ave., Tuckahoe 7, New York

(Presented at the AIC Annual Meeting, May 7, 1952, as part of Concurrent Session B.)

WHEN I was asked to talk about the community relations of our industry, so many important and interesting phases of that subject occurred to me that I was at a loss which to choose. I recalled the morning after a cool, windless fall night when the community very nearly tarred-and-feathered the works manager of a plant I was in because someone had left the wrong damper open in the contact acid plant. Community relations were notably poor after that until we could convince our neighbors by months of untroubled operation that this was an isolated incident and not a regular thing.

Sometimes chemical progress stirs deep resentment as it did for the local farmers when certain of their planted cornfields were virtually commandeered to build a huge chemical plant. Long before the plant was operating, the mere expectation that it would vent certain wastes into the river began to kill fish. At least so the community believed, and some high class detective work was needed to prove to the community's satisfaction that the fish were victims of dynamite blasts set off by malcontents and not of poisoning by non-existent plant effluent.

Occasionally, too, a chemical operation with a good fat pay roll is welcomed to a community only to find after it is established that some of its practices cause serious trouble. One such is an exemplary operation with a monthly pay roll running well into six figures, employing several hundred high class workers and committing no nuisance that anyone could detect. After the honeymoon was over, the works manager was surprised to find his operation and his people subjected to a virtual boycott by their industrial neighbors. The cause of the trouble was finally found in discontent among the community's workers over a too liberal schedule of holidays and other employee policies established by headquarters of the newcomers in a different state. When the differences were corrected to make practice in this respect uniform in the community, peace and friendship were quickly restored.

Or I could dwell upon the unhappy situation our chemical industry has faced from time to time because

combinations, trusts and subsidies were legal in certain foreign nations, but here are practically criminal monopolies and restraints of trade. We might trace the way our community, that is the United States, several decades ago came to the aid of our then infant organic industry to protect it from ruthless foreign competition. But that aspect of our relations with our community has been too often discussed for me to belabor it here.

Or I might outline a timely and pertinent discussion that would weigh the many factors involved in controls to insure the safe use of chemical products. These controls must provide people with their benefits under proper safeguards without at the same time hamstringing progress; they must implement our conquest of disease and destructive pests without creating new hazards that might grow greater than those they destroy.

But all of these specific aspects of our relations with our communities and our fellow men, important as each of them is, are after all fringe phases of the main matter. The basic problem arises from the fact that we chemists, in common with other scientists and technologists in various fields, have succeeded far beyond anyone's expectations in revolutionizing the physical aspects of our lives. Indeed, revolution is a weak expression for the destruction of old ways of life and the creation of new ones of the recent past, whether we think of a span of a half century, a quarter century or even a single decade. That has caused trouble because no one has thought to provide machinery to put these new things to complete and universal use. Our advancing science and especially our enthusiastic and progressively quicker utilization of pure science to provide products of value to us in the United States have created tremendous inequalities among men and nations, and no machinery now exists to equalize these benefits with the rest of the world. Our new medicinal products—sulfa drugs, antibiotics, hormones—contribute unexpectedly large increments to American life expectancy, but instead of opening the way to new plenty, that enlarged supply of man power brings on us idleness and depression that we have sought to offset by fostering a war economy. Our new weapons are surprisingly successful against the pests and diseases of plants and animals that deplete our food supply, and American farmers are paid to destroy foodstuffs at a time when most of the world is plagued by malnutrition. How serious this dislocation of nutrition has become is illustrated by potatoes. Last fall they were left to rot in the Long Island fields but now they are being supplied to the New York market in part by imports from Spain, itself an ill-nourished nation.

The Failure of Distribution

No one can avoid the plain conclusion that our system of distributing the benefits of science, particularly of chemistry and the chemical industry has failed. I would by no means suggest that we chemists leave the occupations we can do well to become salesmen, promoters and distributors, activities at which we would most likely fail miserably. Rather I feel strongly that we must spur others, who can do these promotional jobs well, to do them for us. Working through our various organizations and particularly through their joint and cooperative efforts, we must see to it that these important phases of our own work are not neglected and that experts in such matters are persuaded to undertake them. The time has certainly come when we can no longer remain complacent, flattering ourselves that our duty is over when our researches are finished, our reports written, our patent applications filed and our new product shipped from the plant. Indeed, we with our colleagues in other related fields of science and technology, must assume primary responsibility that our special gifts and talents are directed toward beneficent ends and that the fruits of our labors are developed fully for the greatest good of all men. We have come to the point when we must realize that our community is all human kind. Only by thinking of our destinies against a broad background like that can we properly integrate our skills with our responsibilities.

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We have too long thought of our science as merely a specialized technology having certain valuable and important physical implications. Of course it is that, but in common with all branches of science, it is also a philosophy. We have neglected its philosophical phases in an intense preoccupation with its technological products. Technology continues to develop with a swiftness beyond imagining and at a continuing high acceleration. Its effects destroy our preconceptions and undermine older, more accustomed philosophies. We

badly need to concentrate less on the end products of our researches and more on the new patterns of behavior and human relations that can be built upon them.

Above all we need a philosophy that takes into account the vastly magnified power that applied science puts into people's hands. We need people who can think out the ways to utilize and to equalize throughout our race the abundance that applied science is providing for us. James B. Conant, Hon. AIC, in his Bampton Lectures at Columbia University two weeks ago, spoke of science and the scientific method as "a guide to human action and thus an extension of common sense." He pointed out, too, that a change in the direction of thought especially of scientific thought, seems "far more drastic to those who live through the period of transition than to their descendants" who have the benefit of a certain perspective on the matter. While Dr. Conant was speaking particularly of ideas, the same thing is true of changes in our material surroundings and the activities connected with them.

Lately we have been enveloped in a deep pessimism brought on by spendthrift squandering of our material resources in war. Thoughtful individuals deeply alarmed at this have seriously revived the theories of Malthus who foresaw a century and a half ago that lack of productivity of the earth would limit population within a short time if indeed declining fertility of farms would not actually starve out earth's inhabitants. Unfortunately Malthus lived before the industrial and chemical revolutions had destroyed his premise. Current followers of Malthus' pessimistic doctrine have no such excuse. They have failed to realize the vast power inherent in science today as applied by industry. Let us look briefly into the future.

The Power of Science

Two significant facts dominate our future and turn the pessimists' gloomy picture of tomorrow into one of thrilling promise. We are already practicing methods that will extend all the various assets and resources of our planet far beyond any possible vision of ours. That view is in large measure based on continuing our needs and desires very much as they are now far into the future. But that can only be true for a limited period. Now more than ever before the whole basis of our economy is undergoing continuous change. Slow change continually affects our needs for various commodities and alters their importance to us. Just as the rise of automotive transportation reduced our need for hay once essential to feed draft animals and created a new need for gasoline to fuel internal combustion engines, so other shifts are sure to come in our needs for other commodities, now as vital

to us as hay was half a century ago. These shifts may occur because this or that necessity becomes scarce and high priced, but more likely they will come about because some other newly discovered means will do better the job of an older material. Thus we shall in the future avoid famines for commodities by: (1) stretching our existing resources; and (2) shifting our needs to other channels before scarcity can approach starvation.

We must accustom people generally to think, as chemists do, not of coal, or oil, or farm land, as the thing we need, but rather of heat, energy, nutrition. Stated in particular terms of anthracite, or petroleum, or potatoes, our problems of the future may soon become quite insoluble; whereas in the longer, more general view of heat, power, food, it is quite impossible now to foresee any remote limit in time when these things shall become vital problems because of scarcity. Any conclusions that we can now reach about the probable lives of our assets broadly defined and wisely used are not worth entertaining. Not only are great reaches of time involved, but what is more important, we are always dealing in any forecast with a shifting base, a changing economy.

Malthusiastic fears of early racial starvation were dissipated by the industrial and the mercantile revolutions a century and a half ago. The productivity of human labor and the yield of the soil have continuously risen since Malthus' day. The gap between human needs for subsistence and survival and human productivity continuously widens, and does not shrink as Malthus anticipated.

In 1800, when Malthus' ideas were still new, Robert Fulton, of steamboat fame, predicted that the number of people in what was then considered to be thickly populated England might someday grow to the astounding total of 10 million people. At about that point, he believed, natural forces would place an upper limit on the number and would never permit it to grow larger. Fulton himself contributed through his steamboat in no small measure to the change in basic conditions which now lets five times Fulton's predicted maximum number of Englishmen live in that tight little isle without being aware of Malthus' gloomy predictions.

Nothing could illustrate more graphically than that the folly of trying to extend predictions beyond the life of the conditions on which they are

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based. We shall avoid reaching that far. Nothing here guessed at is subject to greater error than that in Fulton's prediction of the population of England.

The Future for Food Production

Agriculture is just now ready to emerge at need from haphazard dependence on chance and variable seasons. As a result of what are small pilot plant ventures into hydroponics, emphasis has already begun to shift away from the soil, which now supplies moisture and minerals, to the sunshine, true source of plant energy. We cannot yet discern the manifold implications of this shift but certainly it will give an entirely new direction to agriculture and food production as soon as economic forces justify it. Perhaps the most striking effect will be to move "farms" in the new sense up from deep and fertile valleys to high ground, even mountain tops. This apparently silly move would insure that the sunshine reaching the leaves of plants is not filtered through thick, energy-absorbing layers of dusty air. Moreover, specially designed systems will hold rain water for hydroponic farms at high levels to supply these hilltop "farms" and let the excess drain downhill through power-producing machinery. River bottom farms will gradually lose their importance with the dwindling need for soil and its native fertility. Implications of that single change in food production tax the imagination. Its indirect and remote consequences are impossible to foresee on the basis of our meager experience of hydroponic farming.

Biological aspects of future food production also involve revolutionary but less spectacular developments. Breeding and selection of varieties of both plants and animals will insure us efficient food producers. Close control of yields and growth will avert the danger of huge crop surpluses. Conquest of diseases, insects, and other pests that now feed royally on the fruits of our toil is now easily within sight.

Finally, into this picture of the future of eating enters the vital factor of wise food selection. What we have already learned about the effectiveness of various foods and food combinations points inevitably to tremendous strides in bettering our race. Experiments over many generations of laboratory animals supply ample proof that wise selection of foods builds superior beings. Only the slowness of human generations has prevented full proof of that fact with the human race, for certainly the effects of wiser nutrition are clearly evident in the contrast between the rising generation of young men and women and their parents and grandparents.

Thus our future food production and consumption holds staggering probabilities for our descendants. Until the day when such revolution-

ary developments fully arrive, gradual increase in the yields of agriculture will be accomplished by:

(1) improving both in intensity and extent the cultivation and fertilization of our fields;

(2) preserving an ever larger share of the yield of agriculture for human use by the conquest of diseases and parasites that now devour or destroy a large part of our crops;

(3) breeding and selecting for culture plants and animals having promise of the most bountiful return for our labor; and

(4) gradual shift from our present soil-based farming to a new and more efficient sun-based one as our overall economy justifies and requires it.

Metals and Minerals

Minerals and metals can cause us serious concern only so long as our thinking remains tied to an unchanging economy. Of course there is much to recommend the *status quo*, but progressive changes usually make complete revision in the economic base necessary. This is true without revolutionary developments. Depletion of present high grade ores will in the course of time require our iron and steel industry to move to more advantageous spots and to develop and adapt its methods to more plentiful ores of lower grades. Furthermore, the light metals, aluminum and magnesium, are attaining new importance in an air-borne age; and these metals come from sources so abundant that it is inconceivable that they should ever fail. Whether these light metals can now replace, or merely supplement, ferrous metals is of little consequence, since their future and ultimate utility will depend entirely on the direction our developing economy takes. The principal fact is inescapable: with three metals ever abundant, iron, aluminum and magnesium, we shall not want for materials to build structures of any kind we may need.

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New Sources of Energy

Our energy situation appears to be grave now only because again our thoughts are fettered to a desirable, but scarcely unchangeable, present. If we close our minds to all possibilities except our present developed sources of energy, then we are in grave danger of stagnating in a pool of pessimism. We cannot, in this connection especially, afford to ignore the swift gait of progress. Only since the beginning of the present century has liquid fuel occupied *any* place in our ideas of power. Before then petroleum's only value was to replace whale oil in the lamps that lighted our forefathers' houses. At

the turn of the century electricity by supplying brighter, cleaner light threatened that use of "coal oil", and so petroleum refiners turned eagerly to the embryo automobile of that day to see that it grew up to draw power from one of their products instead of some other. The ingenuity that thus powered horseless carriages with internal combustion engines burning gasoline did not expire when it had accomplished that one act. Rather it has continued and still continues seeking to better what it created. That is the reason we need entertain no grave fears of the future of liquid fuels even if all our sources of petroleum should suddenly dry up. Through an indefinitely long future stretching far beyond vision we shall convert solid and low grade fuels into high grade liquids to meet present and changing needs. We can use processes already well understood and now practiced on some, perhaps minor scale.

After that will extend further long epochs when we shall use other sources of energy far more efficient than we now do. Radiation from the sun has poured upon the earth throughout eternity at an average rate equivalent to about 1000 continuous horsepower per acre. The proportion of that caught and utilized in water power and in the photosynthetic processes of plants is quite infinitesimal. Only a tiny part of the latter minute fraction has found its way into coal and oil. Yet the short estimated life of these deposits gives conservationists tremors. No reason appears why man cannot devise methods of employing the sun's radiation far more efficiently than green crops do today. It is merely that we have not yet needed to solve that problem and no economic urge yet presses for its solution.

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as if inserted in the middle of the active, productive adult life of men and women. The progressive lifting from our backs of the oppressive burdens of grueling toil, of long hours and of tedious labor gives the life of the future new thrilling interest.

A Philosophy for Action

These developments now or recently under way typify today's accelerated rate of change. They provide convincing arguments against "selling humanity short" and against prophesying beyond the end of our present habits and customs of life. Examples of what human ingenuity and the practice of the scientific method may accomplish for the general good could be multiplied practically at will. They suggest incalculable value when fully utilized, but hopeless confusion until fully understood. They further suggest the extraordinary power of the scientific method implemented by active minds cooperating with understanding industry, and universally applied. Anything is possible to that combination.

Obviously all of these developments are coming upon us with tremendous speed, far faster than any of the developments that we have watched come to being in the past. By that same token their combined impact and effect upon our economy will be greater by their very velocity and the frequency of the blows to our preconceptions. We must foster a frame of mind, a method of meeting and assimilating these revolutionary novelties of our onrushing future, that will enable us to utilize their values fully for all men. We must develop a philosophy of accepting and adapting and adopting changes so that they will prove benefits and not simply shattering and destructive collisions of the new with the old. Above all we must ourselves understand more and more that our daily practice of the skills of our science leads ultimately to consequences of the most far-reaching effect for all humanity. We must strive to understand this basic fact and to encourage others to study and to understand from that point of view just what we and our colleagues are about. We cannot properly forsake our proper pursuits to engage in others that we do not understand, but we must by all means and by every means stimulate others who can guide people to use the results of our technologies wisely to understand the problems involved and to seek actively for their solutions.

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Accepted: As candidate for the Ph.D. degree at Cornell University, James Wilkens, AIC student medalist for 1952. He will major in physical chemistry.

New Unit: For the production of niacin has been completed by Merck & Company, Inc., near Danville, Pa. This new Cherokee Plant has a capacity of one-million pounds annually.

Speakers: John W. Bodman, F.A.I.C., technical advisor to the board, Lever Brothers Company, who spoke on "Soap Finishing," at the 1952 short course on soap and detergents, given by the American Oil Chemists' Society at Rutgers University, New Brunswick, N. J. July 6-11th. Dr. Foster D. Snell, F.A.I.C., was chairman of the course. Francis Scofield, F.A.I.C., of the National Paint, Varnish & Lacquer Association, Washington, D C., presided July 11th.

New Officers: Of the American Oil Chemists' Society for 1952-53: president E. M. James, technical adviser to the board, Lever Brothers Company, New York, N. Y.; vice president, Procter Thomson, associate director in charge of process standards, Chemical Division, Procter and Gamble Company, Cincinnati, Ohio; secretary, T. H. Hopper, F.A.I.C., head of the Analytical and Physical Division, Southern Regional Research Laboratory, New Orleans, La., and treasurer, J. J. Vollertsen, retired chief, chemical research development, Armour and Company, Chicago, Ill.

Options: Taken on several large tracts of land in St. Louis County, Missouri, by Monsanto Chemical Company, which plans to establish its general offices there, if other land can be acquired and if zoning arrangements can be made.

The Crisis in Compiling and Correlating Chemical Literature

J. W. Perry, F.A.I.C.

Research Associate, Massachusetts Institute of Technology, Cambridge, Mass. Director, Scientific Literature Department, Bjorksten Research Laboratories, Madison, Wisconsin.

(Paper presented at the AIC Annual meeting, May 7th, by the Chairman of Session C, on "The Situation in Chemical Literature.")

A HUNDRED years ago, reading the current literature required only a fraction of a chemist's time. At that time it was not beyond the limits of human endurance to read the entire literature of our science. The literature problem as we know it today did not exist.

During the past century—and particularly during the past fifty years—chemical industry and chemical research have expanded to a point that today they are essential to our prosperity in peace and to our national survival in war. Our profession, while justifiably proud of this record of accomplishment, is inspired by the conviction that past achievements shall be the basis for even greater accomplishments. Let us not, however, deceive ourselves with easy optimism. Building future achievement on past accomplishments is a task which has become increasingly difficult. During the past hundred years, the volume of chemical knowledge has expanded at least 100-fold. There has been much greater increase both in the extent of research activity and in the rate of publication. But the rate at which we chemists can read and understand has undergone no such increase. Today none of us can hope to read the entire chemical literature. Full utilization of the knowledge recorded in chemical libraries is even more important today than was the case of a century ago when chemical industry had scarcely entered its period of development and expansion. For it is only by full utilization of available knowledge that future research can achieve maximum effectiveness. In these days of sharp competition—not only on an industrial but also on an international scale—anything short of maximum effectiveness in research and development is inacceptable.

Since it is no longer possible for any one of us to know everything about all branches of chemistry, recent decades have brought an increasing tendency in our profession toward specialization. But specialization—although effective in restricting the scope of responsibility to the limits of human ability—brings the danger of continually narrowing our field of vision. We cannot hope to achieve the peaks of success professionally, if we fail to bring to bear on our prob-

lems the full range of chemical knowledge. The specialist, working within a narrow range of knowledge,, may solve many problems of a more or less routine nature, but the peak achievements are reserved for those chemists who understand how to utilize the full range of chemical knowledge in their professional work.

A few figures are helpful in understanding the magnitude of the literature problem. During the past five decades, *Chemical Abstracts* has published over 1,200,000 abstracts. At present over 4,300 periodicals contain publications of sufficient chemical interest to warrant their being reviewed by *Chemical Abstracts,* and the current rate of chemical publication produces over 50,000 papers and patents a year. No one knows for certain how many organic compounds have been prepared and described in the literature, but the number is in the hundreds of thousands. Inspired by success in such fields as steroids, vitamins and antibiotics, organic chemists are undertaking the synthesis of more and more complicated molecules.

The literature problem not only has a past and a present. It also has a future. If we plot the size of the decennial indexes of *Chemical Abstracts* on a logarithmic scale against the year on an arithmetic scale we are led to the conclusion that within the next five years each annual index will equal—and soon hereafter exceed —the size of the first decennial index. This situation cannot fail to create concern not only with regard to preparing such indexes but also with regard to their use. How are we going to find the time to use these vast indexes to compile and correlate the information that we shall need when building the achievements of two decades hence on the foundations being laid today?

Human Limitations

In approaching this problem, let us emphasize that human limitations are the fundamental consideration. If we could read several thousand times as fast as we actually can, if our memories functioned perfectly, no crisis would exist. Any proposal to cope with this crisis must be based on a consideration of individual human limitations. Furthermore, in working toward a solution, it is necessary to remember that the most important persons concerned with chemical literature are practising chemists. In meeting their needs and requirements, important functions are served by various specialists such as editors, librarians and those chemists who work in libraries and who are sometimes referred to as literature chemists. All these specialists in chemical literature are exposed—as are all specialists—to the danger of becoming absorbed in their own problems to such a degree that they lose sight of the larger purpose which their efforts are to serve. Let us therefore center our attention on the practising

chemist, his problems and his needs.

Let us imagine a chemist confronted by a research problem. Let us assume that information pertinent to this problem and helpful to its solution is in the literature. The first step toward the chemist's obtaining such useful information is for him to be aware, or at least for him to suspect, that the information in question does in fact exist. This is a relatively simple matter if the useful information happens to be within his field of specialization. The probability that our chemist will be impelled to search out the needed information is then at a maximum. However, there is grave chance that useful information outside his field of specialization may be overlooked unless our chemist keeps himself informed concerning trends in other fields. Even then a high order of imagination may be required to bring the useful information to bear on the problem at hand.

But let us assume further that our chemist has broad vision and imagination and that he suspects, with good reason, that he will be able to locate useful information in the literature. If his information requirements are narrow in range—if, for example, the physical constants of some one compound are required — then the task of locating the needed information is a rather simple one. Looking on a single page of Beilstein or Gmelin may then suffice to put him in contact with the older literature, while consulting one, or at most a few, subject headings in the indexes of *Chemical Abstracts* will enable him to cover the literature of recent years except for that of the latest months. A reasonable amount of time and effort often suffices to find some one fact in the chemical literature.

The situation becomes quite different, however, when a wider range of information is required. It is a matter of good fortune if the required information is to be found already collected in a review paper, textbook or compendium. The chances of being fortunate are usually less, the more original the thinking which underlies the information requirement. The writers of reviews, textbooks and compendia cannot be expected to anticipate future developments and even if they could, practical considerations would prevent them from compiling information in a multitude of different ways to meet the varying needs of different investigators. In the great compilations such as Beil-

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stein and Gmelin one mode of presentation is set up as the standard and the user must accommodate himself to it. As chemistry becomes more complex, it seems inevitable that a fixed mode of presentation of ever-increasing masses of information will become less and less satisfactory for meeting diverse information requirements.

Even if the present format of Beilstein and Gmelin were not the source of dissatisfaction either present or future, there is grave question as to their ability to encompass the chemical literature of the future. Dr. Pietsch in a recent paper has expressed, "not merely the fear but even the clear conviction that the era of the classical handbook is approaching its end." This startling, and disquieting, conclusion is based on observations made by Pietsch with regard to the amount of literature published during the last 20-25 years and the literature published in the 200 years antecedent thereto. The same difficulties are being encountered in the field of organic chemistry. The present edition of Beilstein embraces publications only through the year 1929, although preparations for a third supplement to cover the more recent literature are under way.

In considering the problems confronting the Beilstein and Gmelin, it is well to keep in mind that bringing the literature together in subject archives is not the bottleneck in the operation. The rate controlling process is the preparation of the manuscript—in other words, the compilation operation itself. This highly specialized editorial work is of an entirely different nature than indexing and much slower in accomplishment.

It seems highly probable, therefore, that in the future we are going to be forced to rely more and more on subject indexes as a basis for compiling and correlating needed chemical information. As already noted, it is not, as a rule, an excessively difficult task to use subject indexes of conventional design to locate individual facts or to conduct searches directed to narrow ranges of information. The knowledge stored up in the chemical literature cannot be used to full effectiveness if we do not overcome narrow limitations. Overcoming narrow limitations is not, however, an easy matter. As the breadth of information to be compiled and correlated increases, we are forced to consult a larger and larger number of entries in a subject index of conventional design. The compiling and correlation of needed information may become so tedious that the task is avoided and an experimental program may be initiated without benefit of the background of knowledge obtainable from the literature. When this happens, it is no exaggeration to say that chemical literature is failing to perform its function of communicating the hard-won knowledge of one chemist

to a colleague who can use that knowledge to advantage.

It is not intended to suggest that subject indexes have outlived their usefulness as a means for compiling and correlating chemical literature. The point is that the continuing expansion of indexes inevitably must create a situation in which chemists, subject as they are to human limitations, cannot use them to maximum effectiveness.

Machine Techniques

The very tediousness of literature searching provides a clue to a way out of this situation. It has been demonstrated that tedious repetitious searching operations — particularly those involved in scanning subject indexes—can be reduced to routines. Automatic equipment capable of performing searching routines has been constructed and successfully tested and demonstrated. New forms of subject indexes especially suited to machine searching are now being worked out in detail. These machine techniques will not only make it easier to recall needed information from storage, but due to their inherent flexibility, they will permit searches to be directed to new relationships and will thus perform a function closely analogous to that of association in human memory. Just as the invention of writing and printing relieved human memory of the task of storing factual information, so the newer machine searching techniques will provide relief in accomplishing the recall of needed facts and in compiling and correlating facts into new patterns. There are important possibilities of using machine techniques to surmount human limitations and thus enable chemists to achieve a new level of efficiency in making use of recorded chemical knowledge.

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Meeting the challenge presented today by the chemical literature is a matter for concern not only to our profession but also to chemical industry and to government. Today chemistry is big business and maintaining research efficiency at a high level is an economic and social necessity. Large-scale application of machine-searching methods has ample economic justification as a means for maintaining and raising the efficiency of research and development.

This paper has been concerned with the crisis in compiling and correlating chemical literature and, quite naturally, has emphasized the need for thinking in large dimensions commensurate with the magnitude of the problem. In conclusion it may not be out of place to suggest how success

in developing improved methods for compiling and correlating may affect another important aspect of chemical literature—namely, the writing of comprehensive review papers, monographs and textbooks. If the donkey work of locating pertinent material and arranging it in order can be spared prospective authors, their task will be lightened and they would be able to write in a more comprehensive and up-to-the-minute fashion. Reviews, monographs and textbooks have an important role to play in the future of chemical literature not only for instructing students but for keeping chemists informed as to new trends and developments throughout their careers. The authors of the future will need to give careful thought to improved methods of organizing and presenting their material so that it can be quickly scanned by the reader, thus enabling him to quickly gain a general view of the situation while simultaneously providing a pathway to specific information. This need to save the reader's time guided our retiring president, Mr. Flett, in arranging the material for his book on maleic acid derivatives, now in press.

Summarizing, we can anticipate in the coming years a continuing expansion of chemical literature as chemistry continues to become more and more important to our national welfare. The volume of chemical knowledge will inevitably arrive at the point—if, indeed, it is not already there—at which it cannot be embraced in anything approaching completeness by compendia and handbooks. The use of machines for searching and correlating recorded knowledge is an economic necessity to conserve the time and energy of professionally active chemists. Reviews, monographs and books have an important role to play in keeping members of our profession informed concerning trends and developments in our science.

Staff Engineer: Howard S. Phelps, F.A.I.C., who will carry out the work of the American Society for Testing Materials in connection with the development of methods to conserve scarce materials, on contract to the consultant to the Director of Defense Mobilization on Conservation of Materials. Mr. Phelps recently retired as engineer in charge of the Testing Division, Engineering Department, Philadelphia Electric Company.

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Appointment: Announced by Arthur S. La Pine & Company, 6001 South Knox Ave., Chicago 29, Ill., of Stanley J. Mack to head laboratory furniture sales.

Recent Progress in Textiles

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(Presented at the AIC Annual Meeting, May 7, 1952, as part of Concurrent Session A.)

THE textile industry is a tremendous and complex business. Because of its size and complexity, changes in the industry are seldom spectacular. If we discount the newest Paris creations, the vivid hand-painted neckties, the gorgeous sports shirts, the fluorescent sox, or the Bikini bathing suit, its achievements rarely make the headlines.

It is because of this that many of its critics call the textile industry stodgy and unprogressive. Such criticisms are not based on fact. Many areas of the American textile industry are very progressive.

I must restrict my remarks to the dyeing and finishing portions of the industry. The reason for this is that most of my direct contacts with the industry have been in these areas.

In common with many other industries the tempo of progress and the emphasis on new developments in the textile field are often dictated by forces on the fringe of, or outside the industry. Let me list a few of these forces which have had and will continue to have tremendous influence on the industry. These are not necessarily listed in the order of their importance.

1. The large procurements of textiles for the military. Since the textile industry must process these goods and at the same time maintain a supply for civilian use, more and more emphasis is being placed on continuous scouring, bleaching, dyeing and finishing operations.

2. The changes in the mode of living of the American public. These changes are the result of (1) automatic washing machines, etc., (2) heated automobiles in the winter and the wide open spaces in the summer, and (3) television and radio with their demand for time. One of the results is the demand for clothes and household furnishings that require a minimum of effort in maintaining appearance and utility.

3. The wide fluctuations in the price of wool. During the past year garment wool tops dropped approximately $2.50 per pound from an all-time high. The market for raw wools is still unsteady. (How would you like to run a chemical plant with

such wide fluctuations in the basic raw materials cost?)

4. The many new non-cellulosic man-made fibers that have been announced.

5. The recent reduction in price of viscose rayon and cellulose acetate staple fiber. It is of interest to note that these fibers are now as cheap as, or cheaper than, some grades of cotton. If we can forget the political implications of this condition, this is a very interesting subject for speculation. (Imagine being able to use viscose rayon as a diluent for cotton!)

Continuous Dyeing Procedures

The cotton and rayon finishing plants have led the way in the use of continuous dyeing procedures. The two principal types used in this country are the pad-steam ranges and the William's unit ranges. In England the Standfast or molten metal dyeing machines are in use. This type of machine will be introduced into this country very shortly. Incidentally, William's units have been modified to simulate the action of the Standfast machine.

An extremely brief description of the essential parts of each range will have to suffice. The essential parts of the pad-steam ranges are (1) rubber-covered mangles or rolls for application of dyes and necessary chemicals and (2) a steam chest for development and fixation of the dye.

The William's range consists of a padder and a number of departmentalized dye boxes. In the Standfast machine, the cloth is pulled through a shallow dye bath which floats on top of a molten metal bath, e.g. Woods Metal. The wet cloth is then passed through the hot metal where development and fixation takes place. In the modified William's range the dyes and chemicals are padded on the cloth which is then passed through hot mineral oil.

The pad-steam and William's units run up to 120 yards per minute with a good average around 100 yards per minute. The best estimate on speed of the Standfast is 60-80 yards per minute. Obviously at these speeds the contact time between cloth and dye and chemical solutions is a matter of seconds. In order to get good dye penetration the dyeings must be made at rather high temperatures. Herein lie the difficulties.

The greatest difficulties were encountered in the application of vat dyes, particularly the Indanthrene Blues. The parent of these dyes is Indanthrene Blue RS which is prepared by the alkaline fusion of B-aminoanthraquinone.

The leuco or substantive form of these dyes is made by reduction with hydrosulfite in caustic soda solution. Although there are four places where reduction can take place, it is believed that best results are obtained when only two groups are reduced. It is known that over-reduction destroys these dyes insofar as good com-

mercial dyeings are concerned. High temperatures greatly increase the rate of over-reduction.

Considerable work has been done on this problem and many chemicals have been tried in an effort to control the oxidation-reduction system. Inorganic halogenates, inorganic nitrites, e.g. sodium nitrite, and organic nitrogen compounds, e.g. nitropropane, hydroxylamine, etc. cause excellent results to be obtained. Small amounts of these chemicals are highly efficient in preventing over-reduction. The effectiveness of these chemicals in maintaining a constant oxidation-reduction potential can be shown by placing a recording potentiometer in the system.

Speaking of hydroxylamine, its sulfate or hydroxylammonium sulfate is a very important factor in dyeing the acrylic fibers. It has been reasonably well-established that it controls the reduction of cupric ions to cuprous ions which appear to be the effective dyeing assistant for acid and direct dyes. The mechanism is not entirely known but a well-supported hypothesis points toward the chelation of the copper with the free nitrile groups of the fiber which produces active sites for dye absorption and retention.

This new and potentially large use for hydroxylammonium sulfate is a good example of the kind of development that makes commercial chemical development departments happy and production managers turn gray.

Although the cotton and rayon dyers have led the way in using continuous dyeing and finishing ranges, some progress along these lines has been made in the wool industry. One of the most interesting of the developments which has been announced is the Bachman-Uxbridge high-temperature, piece-dyeing machine (1, 2). The essential parts of this machine are, (1) a padder for the application of dyes and chemicals and (2) a developing tank which is enclosed in a large pressure vessel. Dyeings have been made at temperatures up to 270°F. It is claimed that wool piece goods can be dyed at 25 yards per minute.

As a corollary to this, it should be pointed out that the advent of the many synthetic hydrophobic fibres has increased interest in dyeing yarns and raw stock at elevated temperatures. Package and raw stock dyeing kettles are being made to operate at temperatures around 250°F.

An interesting development in the coloring of fabrics made from glass fibres was recently announced. It has been stated that affinity of glass piece goods for vat pigments has been created by cross-linking methyl vinyl ether maleic anhydride copolymer with polyvinyl alcohol. This product is reported to improve the wearing qualities of the glass fabric.

Textile Finishes

The change in the mode of living of the American public has, in my opinion, been directly or indirectly responsible for many important developments in textile finishes. As a result the average American is placing more and more emphasis on comfort, without too much sacrifice of style, and on the ease of maintenance of clothing and household furnishings.

Considerable evidence to support both of these statements can be found. Those who wear vests are in the minority. Suits are also made from much lighter weight fabrics than was the case several years ago. Indeed, it would not be surprising to find a few viscose and acetate rayon suits. Those who travel a great deal probably wear either Nylon, Dacron polyester or Orlon acrylic fibre shirts. The name of the fibre may have attracted them to the counter; the ease of washing may have sold them, but there is one thing for certain, the shirts that were purchased recently are much more comfortable. This all adds up to the fact that the textile designer, as well as the textile finisher, is constantly aware of these two trends.

The use of tallow, oils, starches and gums to give textiles, particularly cotton and linen, a more pleasing hand is older than the textile industry. These materials properly handled are still excellent and important finishing agents. Their obvious weakness lies in the fact that they are not permanent and hence must be reapplied after every washing. Another important factor is the ease with which the starches can be used in the home laundry. In spite of the ease of application the American housewife is not very enthusiastic about this process. If the trend in textile finishing continues at its present rate, the days of home finishing appear to be numbered.

Before discussing the progress of the textile finishers in the field of functional or utility finishes, some mention should be made about the progress in imparting flame-and mildew-resistance to cellulosic fabrics.

Flame-Resistant Finishes

The need for flame-resistant finishes was dramatically illustrated by the headlines featuring the so-called "torch sweaters". Brushed rayon was made the "goat" but any high-pile cellulosic fabric will burn with equal ease.

A number of water-soluble products have been used for many years to impart flame-resistance to cottons and viscose rayons. Among these are borax-boric acid mixtures, ammonium sulfate, ammonium sulfamate and ammonium phosphate. As a group these have at least three major drawbacks, namely, (1) they are not permanent to washing, (2) they are hygroscopic and (3) ammonium salts, on storage or when subjected

to heat, liberate strong acids which tender the cotton.

Recently phosphates of strong organic bases of the guanidine type have been introduced into the trade as flame-resistant chemicals. These are very effective, are non-hydroscopic, and because they do not decompose on heating or by hydrolysis, they overcome some of the deficiencies of the salts mentioned earlier. They are, however, more expensive to make and apply.

Flame-resistant finishes that are durable to dry-cleaning and semi-durable to mild alkaline washes have been applied to cellulosic materials. Some of the earlier work involved the saturation of the fabric with a 10-15% solution of diammonium phosphate and urea or dicyandiamide. The fabric is then dried and baked. Unless carefully controlled this process is prone to tender the goods. More recent procedures employ phosphates of carefully selected organic bases in combination with urea-melamine and formaldehyde resins. The result is less tendering and better durability.

The task of producing a flame-resistant finish which is durable to vigorous laundering, particularly commercial laundering, is an extremely interesting and difficult problem. It is of interest to point out a few reasons. It has been well-established that the most effective "flame-proofing" chemicals are amine phosphates. Unfortunately these chemicals act as ion-exchange compounds with the amine or ammonium portions being replaced by sodium in alkaline washing with a marked decrease in efficiency.

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Another interesting process involves the use of the oxychlorides of titanium and antimony. These compounds are applied to cellulosic materials in water solution under careful pH control. Subsequent operations precipitate the oxides within the fibres and threads. Such treatments are quite durable to cleaning operations and are very durable to weathering.

The fact that the oxides of both antimony and titanium are white will limit the use of this process on wearing apparel and household furnishings. Cloth so treated cannot be dyed and application after dyeing gives the goods a "frosty" appearance.

Mildew Resistant Finishes

The problem of making cellulosic materials resistant to attack by microorganisms is important economically. The use of mercurials, certain diphenylmethane derivatives and organocopper compounds such as copper

naphthenate and copper-8-quinolinate is well known. With the exception of some restricted uses for the diphenylmethanes these compounds find little use for clothing, etc.

There are, however, three recent developments which should be mentioned because the preliminary work indicates promise. These three are: (1) The Southern Regional Laboratory located in New Orleans has shown that partially acetylated cotton is resistant to the standard soil burial test. (2) It has been reported that cotton treated with acrylonitrile has considerable resistance to attack by fungi and soil bacteria. Considerable work must be done on both of these processes before commercialization is possible. (3) This method is interesting because it has been available for many years and millions of yards of goods have been processed without an announcement concerning this property. It has been reported rather recently that urea-formaldehyde and melamine-formaldehyde resins applied to cotton fabric give unexpected resistance to the standard soil-burial test.

Water-Repellent Finishes

The newest development in producing water-repellent finishes to textiles involves the use of silicones. The first successful water repellent for textiles, based on silicones, is believed to have a methyl hydrogen silicone polymer as the main active ingredient. This, of course, can be prepared by the careful hydrolysis of methyl hydrogen dichlorosilane. This product according to reports has two defects that restricts its use. One, these polymers are water insoluble and hence must be applied to textiles in an organic solvent or as an emulsion. Two, hydrogen is liberated in the presence of water and the emulsions are unstable. These products give good results on the hydrophobic fibers, acetate, nylon, etc. but poor results on cotton because of poor wash resistance.

There are, however, two silicone products available on the market which are reported to give water-repellent finishes that are quite durable to washing. One product is a wax-like substance which can be dispersed in water and applied. The other is sold as a stable emulsion which must be used, according to the supplier, in combination with a special catalyst. No reference as to the composition of these products has been found.

Utility Finishes

The most dramatic development in the textile field are in the so-called utility or functional finishes. If the use of starches, etc. be discounted, the oldest and most publicized functional finishes would be Sanforized cotton and the Tootal-Broadhurst & Lee process for creaseproofing cellulosics by the application of urea--formaldehyde resins. The importance of Sanforized cottons needs no comment.

The importance of Tootal-Broadhurst and Lee's contribution is supported by the fact that urea-formaldehyde is still the "work horse" chemical in this field.

The next advance in chemical finishes was the introduction commercially of melamine-formaldehyde resins. These led to applications to wool for shrinkage control. When properly applied these resins reduced the tendency of wool to felt when subjected to stress when wet.

During this period considerable work was done in an effort to produce urea and melamine resin-formers with better storage stability. As a result of this work products such as dimethoxymethylolurea and trimethoxymethylolmelamine became available. These not only were more stable but in addition produced finishes with different properties.

During the past several years there has been considerable controversy of the comparative merits of chlorinated and resin-treated wools. An interesting experiment was conducted in an industrial plant in an effort to determine the wear resistance of chlorinated and resin-treated wools. Twenty pairs of trousers were made with one leg from chlorinated wool and the other leg from resin-treated wool. In addition to normal wear, these trousers were subjected to a normal plant laundering procedure during the period of test. In all 20 garments the chlorinated wool showed fabric break-down of one sort or another, whereas in most cases the resin-treated wools only showed normal wear. This severe test indicates that resin-treated wool has better wear resistance than chlorinated wool.

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The regular and modified urea- and melamine-formaldehyde resins require curing in the presence of a catalyst, usually an amine salt of a strong acid, at relatively high temperatures, e.g. 300-350°F. Certain light weight fabrics may be damaged by this treatment. This type of fabric, however, has been successfully resin-treated by means of an organic acid colloid of trimethoxymethylolmelamine. Organic acids that have been used are lactic, acetic and glycollic. In this process the desired concentration of the acid colloid is applied after which the cloth is dried for 4-5 minutes at 250°F. To illustrate this treatment two pieces of a dotted swiss fabric were exhibited, one with resin treatment and one without. The effect of resin treatment was very apparent.

Two of the outstanding properties

of nylon are its strength and resistance to abrasion. When made into a marquisette net or lace, these properties are of no value because the nylon netting will not drape properly and has little or no fabric stability. Two pieces of nylon netting were used to illustrate this point. It is apparent that the application of melamine-formaldehyde resin changed the limp fabric with little or no sales appeal to a crisp fabric with definite character.

Along with these modified methylol ureas and melamines, the textile finisher has been literally deluged with softeners, accelerators and additives of many kinds, all designed to modify the finish. Many of these softeners and additives did modify the finish in the direction indicated by their chemical nature. Occasionally, however, some exhibited anomalous behavior.

During the past few years the textile finishing industry has been capitalizing on these findings by using combinations of materials carefully blended to produce the desired finish. It is obviously impossible to list all of these combinations of finishes obtained thereby. A combination of urea-formaldehyde, a melamine formaldehyde-resin and a water-repellent finishing agent produced a fabric which has good wrinkle resistance, is water-repellent and shows good resistance to soil and spotting. By varying the composition of each of these ingredients, a wide variety of finishes can be obtained.

Glazed chintz has been known to the trade for many years. This type of fabric is made by applying the finishing materials and then subjecting the cloth to friction calendering. The early chintzes were made with a starch finish and, of course, the glaze was not permanent. Most of the glazed chinz made today is finished with urea- or melamine-formaldehyde resins as the basic materials. These finishes are very durable since they will withstand dry cleaning and washing.

At the moment one of the most interesting developments in textile finishing is the production of embossed textiles. Some are made by using a Shreiner calender with a very lightly engraved roll. Deeply embossed textiles are made with an engraved metal roll heated to 300-350°F. As the cloth passes through the calender, it is actually molded into shape. These embossings are very permanent.

Recently there has been considerable activity in stabilizing rayon fabrices. For certain end-uses, the stabilization with urea- and melamine-formaldehyde resins are not quite adequate. The percentage add-on is too high or the hand too crisp, etc.

During the past few years a number of processes have been announced for stabilizing viscose rayons against shrinkage with a minimum of add-on.

Among these are, (1) the use of glyoxal as the active ingredient, (2) the use of an alkali soluble cellulose ether in combination with formaldehyde and a textile softener and (3) a process announced by Dan River Mills called X-2. The chemistry of the X-2 process has not been announced, but it is claimed that the active ingredient is a chemical capable of cross-linking the cellulose molecules which is superior to formaldehyde or glyoxal.

The author wishes to thank the American Viscose Corporation, Dan River Mills, Inc., the Rock Hill Printing and Finishing Company, and the Textile Resin Department of the American Cyanamid Company for samples made available for this presentation.

Official Laboratory: Appointed by the National Association of Soft Water Service Operators, is Foster D. Snell, Inc., 29 W. 15th St., New York 11, N.Y. First research problem assigned by the Association: Corrosion affecting soft-water service operators.

Resigned: George A. Wrisley, F.A.I.C., as chief of the Glycerine, Soaps and Detergents Section of the National Production Authority's Chemical Division, to return to his position as vice president of the Allen B. Wrisley Company, Chicago 38, Illinois.

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Small Business Firms: Filled more than 85 per cent of the orders for supplies bought by Standard Oil Company (New Jersey) and its North American affiliates during 1951. Total amount of purchases from all suppliers amounted to $401,505,871.

Larger Bales: Of Dynel, new synthetic fiber, are now being prepared by Carbide and Carbon Chemicals Company. Carl A. Setterstrom, F.A.I.C., sales manager of the Textile Fibers Department, said the increase in bale weight from 350 pounds to 400 pounds net of fiber was made to reduce freight and handling expenses.

Construction Program: By Heyden Chemical Corporation, to double its present productive capacity for penicillin and other antibiotics, is now underway, as announced recently by John P. Remensnyder, F.A.I.C., president of Heyden.

Recent Progress in Agricultural Chemicals

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(Presented at the AIC Annual Meeting, May 7, as part of Concurrent Session A.)

AT the risk of giving short shrift to those expecting an evaluation of the relative values of various chemical agents, I shall consider primarily recent progress in the market for agricultural chemicals. No thoughtful person considers that the quantity of chemicals sold to agriculture in 1950 could have been marketed in 1920 or even in 1930. Without deprecating the substance of the contribution made by chemical ingenuity, I submit that economically, at least, the value of a product or service created is not realized until it is employed and it has been the readiness of the market to employ the chemical tools provided that enables us to consider recent progress in agricultural chemicals.

For a time then may we pay the chemist the dubious compliment of taking it for granted that typically his future technical contributions will increase geometrically and consider what assurance we may take from the market developments of the last few decades that his efforts will be economically fruitful in the next.

Since we farm only to eat, it is basic to consider how many there are of us to be fed and how each of us performs at the table. If this century's population trend, excepting the decade of the 1930's, continues we should plan for approximately 180 million table settings in 1960, an increase over 1950 of 18 per cent.

The behavior of the individual at the table, however, is somewhat less predictable. It has been demonstrated that he will eat more under favorable conditions. For example, in 1946, we were eating on the average of 19 per cent more food than we consumed from 1915 to 1935. We ate less following that period as food prices rose with respect to our incomes and as other goods became available in competition for our dollars. There is ample evidence also that we have marked preferences in foods. For example, between 1910 and 1948 our consumption of fruit and vegetables increased approximately 60 per cent; dairy products approximately 40 per cent; eggs approximately 20 per cent, while we decreased our consumption about 25 per cent of potatoes and cereal products. Significantly, the increase in

our consumption of favored food types was not accompanied by any increase in the share of our purchasing power which we are willing to devote to them.

I believe it can safely be concluded that in this decade we will have an increase in requirement for food products generally amounting to approximately 18 per cent due to population increase. In addition, if the prices of fruits, vegetables, dairy products, eggs, and meat are such that we can increase our consumption per capita without expending a greater share of our income, I believe the potential increase for these selected food types can be very great. To put it another way—if American agriculture increases its productivity through the employment of techniques available to it, and if the gains through productivity increase are shared with the American Consumer through the medium of lower relative prices, very substantial increases in potential market for fruits and vegetables, dairy products, poultry and meat can be anticipated with attendant active market development for the chemicals associated with the production of those high value commodities.

Granting favorable demand factors, what of supply? Since 1920 the acres harvested for food have remained substantially constant at 350 million acres. To some extent the resulting lag in this productive resource has been offset by a 77 per cent reduction in work animal population. Nevertheless, supply has matched demand only because of the employment of devices increasing productivity per acre.

Since 1940, the farmers' investment in farm equipment has increased from 5 to 17½ billion dollars. While no halt in the development of farm machinery is anticipated, particularly in specialized equipment as cotton pickers, the American farm is mechanized and productivity gains will be increasingly marginal. The last fifteen years has witnessed almost complete establishment of hybrid corn. The efforts of plant breeders have been effective in other commercial crops producing higher yield, disease-drought-and pest-resistant strains. Progress along variety lines is well-launched and cannot probably continue to contribute to productivity at the same rate. Important productivity gains have been achieved through progress in the technology of farm and land management.

In spite of these achievements it is the opinion of many agricultural leaders, notably USDA and state authorities, that the force of these devices to contribute increasing productivity is largely spent, so that we must look elsewhere for techniques. These leaders almost unanimously point to fertilizing materials and other agricultural chemicals as the primary device in sight. This view-

point is not unopposed. I refer to the field day which the cultists and faddists have been enjoying at the Delaney hearings in Washington. There is hazard that the sensational nature of their claims prompted by zeal rather than reason will encourage repressive legislation or regulation. Fortunately the scientific leaders of the country have opposed this trend. I invite your consideration of how safeguards to public health may be assured without jeopardizing that health through inadequate employment of the products of chemistry, and your active support of the program you can endorse.

However, let us hope that unemotional consideration of the issue establishes the conviction that if demand continues to mount, the gap developing between it and current productive levels must be bridged by agricultural chemicals. Assuming their availability, their most expeditious employment can be achieved by understanding the agricultural environment in which they will be used.

The most important fact to the supplier of agricultural chemicals is that his market is a mass market. One pound per acre on one per cent of 350 million acres is 3½ million pounds. Not a picayunish chemical market, nor over ambitious when it is considered that fertilizers run annually to some 15 million tons. A disheartening corollary is that the 3½ million pounds may be sold to 60,000 customers, so that personal solicitation is hardly the method.

It is essential to understand that agricultural chemicals are employed in the farmer's enterprise to increase the value of his output or to decrease attendant cost. He does not buy them on an emotional basis or because they, as consumer goods, satisfy a personal want or need. Accordingly, the secret of selling such chemicals is to secure identification in the farmer's mind of the service which they render and its value to him as a producer.

Such an approach is possible currently to a degree not even envisioned a decade or so ago. In that period farming has gone through a transition from a way of life to a business undertaking to a very significant extent. One need only consider the increase in capital investment necessary for farming enterprise; the increasing degree to which cash transactions are required for labor, services and operating supplies, as well as the increased necessity of accounting to the tax collector. Inexorably the farmer is being required to know his costs of production and evaluate devices capable of reducing them.

A particularly important consideration in marketing agricultural chemicals is the increasing complexity of the farming enterprise. Traditionally, the farmer is a jack-of-all-trades. In the last fifteen years the tremendous strides in the basic sciences involved in agriculture, as agronomy, plant

physiology, entomology, biology, and chemistry, to name but a few, have made it impossible for the farmer to keep abreast of the agricultural art. Accordingly, he has had increasingly to rely on specialist services for counsel and technique in order to do the best job of farming.

In the light of these considerations let us consider briefly the assigned topic. I must note that without the kind assistance of Dr. Decker of Illinois and Drs. Sylvester and Hoffman of Iowa, we would hardly have considered it at all.

The principal classes of agricultural chemicals may be cited as: (1) fertilizer materials, (2) insecticides, (3) herbicides, (4) fungicides, (5) antibiotics, (6) soil conditioners.

Fertilizers

The dramatic fact regarding recent developments in fertilizing materials is the expansion of use tonnagewise. From a prewar average of 1½ million tons of contained plant food, consumption rose by 1950 to over 4 million tons. The supply by 1955 will exceed 7 million tons, an approximate five-fold increase since prewar. While the last decade has witnessed development in fertilizer rates and placement, employment of radioactive phosphorus and heavy nitrogen are greatly accelerating research progress. New products or techniques have made their commercial debut as foliar feeding with urea, production of nitro-phosphates from nitric acid, acidulation of phosphate rock and production of nitric acid by direct air oxidation. Other developments pioneered in the thirties, find their application greatly expanded as the direct application of anhydrous ammonia and the production of concentrated superphosphates. A recent development not directly related to agriculture but with potentially great indirect effect is the recovery of uranium from phosphate rock.

Insecticides

Insecticides by size rank most important in the field of pesticides, which as a whole will increase in demand by above 9 per cent this year over last year. While the oldest insecticides, sulfur, copper, and arsenicals, retain their lead tonnagewise; the organics starting with DDT during the war have expanded the potential market for insecticides generally. Through increased efficiency these products have not only made possible the broadening of chemical control previously practiced, but also have extended control to pest and crops not previously considered economical or practical to treat. As insect damage to crop production is estimated to approach 4 billion dollars, the industry would seeem to face a virile future. Some indications of this may be taken from recently announced DPA 1955 goals which contemplate approximately one-third increase in capacity from 1951 of DDT and

Technical BHC. ... may be of interest to review last year's requirement of the principal insecticides. Roughly in millions of pounds sulfur ran around 350, coppers and arsenicals around 100; BHC, DDT, and Toxaphene around 55; rotenone around 10; Parathion, Dichlorobenzenes, Chlordane, Aldrin and Pyrethrum around 5.

Herbicides

Beginning with the introduction of 2,4-D, the commercial development of growth regulators has proceeded at a fantastic pace undeterred by failures and fiascos. One fact is certain, the principle of chemical weed control as an economic expedient is firmly planted in the minds of agricultural leaders. The unresolved question is not "whether" but "which". The prize in the contest is a share of the profit to be derived from the elimination of five billion dollars of weed damage to agricultural production annually.

Herbicides are selective or gross killers or regulators. If selective they may regulate grassy or broadleaf species. To date of the organic series, only 2,4-D, a broadleaf killer, has established great commercial stature. In the grassy division, IPC is attracting attention in the Northwest, while "druthers" are being chosen in the cotton South among CMU, 3 chloro IPC, and the dinitros. Urban agriculturalists will be interested in maleic hydrazide which shows some promise as a growth regulator for grass.

It may be interesting to note that this season, requirements are estimated at 30 million pounds for 2, 4-D, as acid, and sodium chlorate, around 5-million pounds of 2, 4, 5-T and sodium arsenite, with miscellaneous and defoliants requiring 67-million.

Fungicides

Organic fungicides have not "blasted off" in the spectacular manner of insecticides and herbicides, although estimates of damage to agricultural production are of the same order. It has been suggested that damage of this type, being less obvious to the farmer, cries less for correction.

Until the end of World War I, the field of fungicides was limited primarily to sulfur and copper chemicals. Shortly thereafter organic mercurials were introduced for seed treatment. This use though not large with regard to usage of fungicides on vegetables and orchards can pay returns as high as $34 of income per $1 spent for chemicals.

The principal recent line of development in fungicides began in the early forties with the advent of the dithiocarbamates and the quinones and continues to broaden to include new families of chemicals. Future development of controls for cereal rusts constitutes a great potential for fungicidal development.

It should not be inferred that agricultural chemicals are limited to

the classes treated in this paper. Actually a host of chemicals used for miscellaneous purposes might be cited, of which defoliants, rodenticides, stop-drop chemicals, ripening agents, sprout inhibitors and the like are representative.

Antibiotics

Time does not permit the treatment of the principle embodied in the agricultural use of antibiotics, but the potential importance of such a contribution must be recognized. This principle simply recognizes that there are two methods of building meat. One is to increase the input of tissue-building elements; the other to eliminate the forces active in the life of an animal which dissipate such elements. Basically, the first man who battery fed chickens was thinking along the same lines. The significance of the application of this principle to the larger animals so far as our future meat diet is concerned may be spectacular. There are indications that thought is being devoted to methods of providing beef cattle with a surplus of nutritious foods and then conserving intakes by chemical methods to reap optimum gains. In a crude way, this has been accomplished in the feed lots.

Soil Conditioners

One of the must spectacular developments of recent times has been the announcement by Monsanto Chemical Company of its Krilium. There are perhaps four primary factors which regulate the rate of plant growth and development. Without attempting to rank these according to importance, they are: Presence of moisture; presence of adequate plant nutrition; suitable soil pH, and suitable soil structure. Soil structure has historically been a matter of land management with conditions frequently prevailing which were impossible or uneconomic to control by management. Krilium is the first frontal attack by the chemist on the use of a supplemental material to achieve a desirable soil structure. It is quite likely not to be the last. In fact, American Cyanamid has recently announced a parallel development in its X19. Such a material presents an almost classic example of elasticity of demand in that the quantities utilized will be limited only by the price at which they are made available.

Summary

In summary, it is my belief that an active and growing market exists for the products of agriculture. On the other hand, the productive factors which have resulted in so substantial an increase of agricultural productivity in the past two to three decades are showing some signs of weakness in their ability to continue to increase productivity at the same rate. Environmental factors surrounding the farmer are bringing

him more and more to rely on the services of specialists who can show him how to increase the value of his output without proportionately increasing his cost of production. It is my belief and that of many others that agricultural chemicals offer the best expedient for the application of this technique and that the markets available to those who are willing to undertake to sell production techniques to six million producers are bright indeed.

A note of caution: All of us active in this field should remember that no product is sold until the buyer is receiving satisfactory service. The farmer, applying an agricultural chemical for the first time in a newly developed applicator by an unfamiliar technique while mentally only recently reconciled to the necessity of the operation, needs all the assistance and instruction we can give him. If we are unwilling to retard him as a prospective chemical customer, we can do no less than provide it.

Certified: Dr. Bernard L. Oser, F.A.I.C., as a specialist in human nutrition by the recently established American Board of Nutrition. He is director of Food Research Laboratories, Inc., Long Island City, N.Y.

Appointed: By the Commonwealth Engineering Company of Ohio, Dayton 3, Ohio, Alfred Lippman, Jr., as general manager of its laboratories.

Merged: The General Development Department and the Patent Department of Monsanto Chemical Company into one department to be known as the Patent and General Development Department, under the directorship of J. Russell Wilson, former director of the Patent Department. W. K. Menke, F.A.I.C., who has been director of the General Development Department since 1949, has resigned to join the Pittsburgh Coke and Chemical Company, Pittsburgh, Pa.

Changed: The legal name of Ladislaus Balassa, F.A.I.C., to Leslie L. Balassa. He is head of Balassa Research Laboratories, 47 Laurel Way, Madison, N. J.

Business Leadership

"Businessmen have jobs to do, which keep them preoccupied and sometimes over-burdened. They are keeping their thoughts their leadership, confined to the realms of their offices, their laboratories, their factories, or their markets. The time has come when this leadership must be shared outside of these realms, or we must face the loss of the basic principles which made this country what it is today. So let us face the issue squarely in the days ahead. Let business leadership broaden its horizon by fitting its time and thinking into broader spheres."

—Hans A. Eggerss, *President*
Continental Can Co., Inc.

Committee on Professional Education

Annual Report

1951-1952

ONLY occasionally does a spectacular movement take place in education. In fact, we look upon such as circus maneuvers. The advertiser is present all right in educational institutions. But whatever his value he is not an educator, any more than the officer is an educator who Warwicks his staff instead of encouraging research and ideas in his teachers. The Warwick, whatever he persuades himself, is a self-seeker, not an educator. He builds for himself and not for student or society. So he quickly becomes a builder for the State, not for the citizen, because totalitarianism is his very life-blood, though his password always is "democracy."

We all know deans, presidents, and trustees who are as true as steel—whose one objective is support of the working-teacher, and the removal of all hurdles in the teacher's way. But there are others, who really are education's greatest handicap, under whom teaching has a struggle for existence.

Educational Warwicks generally find accrediting a tool ready to hand, for accreditors frequently, too, are Warwicks seeking place for Ph.D's. or otherwise, but these, too, have true enough souls among their numbers. Therefore, results do come with time.

There are more important handicaps—namely one's own shortsightedness as a teacher.

In education, like everything else, there is always a pull down-hill from what is achieved. It is to the credit of really higher education that it makes every effort to minimize the loss by retirement of the experience of the experienced. Also it is obvious that with so much to pick from, when developing intensive training, that the subsequently useful (not merely technical) plays a large part. More backward institutions (or leaders) abandon too readily the wearisome (to the teacher, at least) literature seminar, for instance. But the informed hang on, for industry finds more and more that the excellent librarian of even technical training or experience cannot always replace the lack in those products of graduate training who cannot jump into the literature with experience at crucial points of a problem. Lack of continuous training while at graduate school justly brings criticism from industry, as does the ultra-narrowness which it begets.

Recent *ipse dixit* from Washing-

ton to the effect that engineers and chemists are a "dime a dozen," is now confessed to have been a blunder —as it was indeed capital wasted unnecessarily. Resulting fall-off in students is not merely a tragedy to industry. It invisibly but surely will harm scientific development itself for a long time to come.

These were not ripples. This error was a tidal wave, which will recur far down into secondary education for quite a while to come. To dislodge such a mistaken educational notion is difficult indeed.

The origin is hard to find. It may be deep-seated planning of a deadly kind.

What we shall do about the excess of research back-log in the files of industry over ability to apply is not clear. Here, too, the origin may be deeper than we think, and in places we do not clearly comprehend as even related. We may find what harms industry is not merely punishing those whose philosophy or even ethic we do not like, but it affects the well-being of all of us and posterity.

We are not agreed on these things. We are dumb indeed. Formal education seems helpless.

The INSTITUTE is neither an educational nor an accrediting organization. Yet maybe we are both. The INSTITUTE, through its publication, THE CHEMIST, maintains its habit of definite critical contributions to professional education in chemistry, which are not merely helpful but cannot be ignored.

The INSTITUTE is a Forum with whose individuals no one is compelled to agree entirely or be accredited. So it continues to furnish high grade educational ideas. Look at almost every issue of THE CHEMIST. The INSTITUTE's interest in education is deeply reflected down to the very last issue as this report goes in.

Education continues to be the nation's big business. It is to the credit of educators (even like the INSTITUTE) that the waves of evil (nothing new in history) make few ripples when they surge into (or over) educational institutions from the public schools to the super-graduate work of industry. This does not mean we are always happy about those experiments which seem based on sidestepping of the difficult.

—DR. JAMES R. WITHROW
Chairman

New Construction: At the Wyandotte works of The Pennsylvania Salt Manufacturing Company to increase its production of synthetic anhydrous ammonia by 110 per cent. The new facilities will cost $2,200.000.

Professorial Lecturer: Dr. Henry R. Kraybill, F.A.I.C., director of scientific research for the American Meat Institute Foundation, who will lecture in food technology at Illinois Institute of Technology, Chicago.

COUNCIL

OFFICERS

President, Lincoln T. Work
President-elect, Donald B. Keyes
Secretary, Lloyd Van Doren
Treasurer, Frederick A. Hessel

COUNCILORS

John R. Bowman, *At-Large*
Emmett B. Carmichael, *Alabama Chapter*
C. C. Concannon, *At-Large*
M. L. Crossley, *At-Large*
T. R. Donlan, *New Jersey Chapter*
Gustav Egloff, *Chicaago Chapter*
Gustav Egloff, *Past President*
G. J. Esselen, *At-Large*
L. H. Flett, *Past President*
Milton Harris, *Washington Chapter*
M. J. Hiler, *Ohio Chapter*
L. B. Hitchcock, *At-Large*
H. O. Kauffman, *Niagara Chapter*
M. J. Kelley, *New York Chapter*
R. H. Kienle, *At-Large*
Harold A. Levey, *Louisiana Chapter*
John H. Nair, *At-Large*
Donald Price, *At-Large*
M. Sittenfield, *Pennsylvania Chapter*
Foster D. Snell, *Past President*
Raymond Stevens, *New England Chapter*
Manuel Tubis, *Los Angeles Chapter*
Florence E. Wall, *At-Large*
Albin Warth, *Baltimore Chapter*

National Council Meetings

Meetings of the AIC National Council are scheduled to be held at The Chemists' Club, 52 East 41st St., New York, N. Y., at 6:00 p.m., on the following dates:

September 10, 1952
November 12, 1952
January 14, 1953
March 11, 1953
April 8, 1953
May 11, 1953

May Meeting

The 282nd meeting of the National Council of *The American Institute of Chemists* was held May 6, 1952, at 7:00 p.m., at The Chemists' Club, 52 East 41st St., New York, N. Y., preceded by a reception at 6:00 p.m. Retiring president Lawrence H. Flett presided.

The following officers and councilors were present: J. R. Bowman, M. L. Crossley, G. Egloff, L. H. Flett, P. J. Gaylor, (alternate), F. A. Hessel, H. O Kauffman, M J. Kelley, M. Sittenfield, F. D. Snell, R. Stevens, F. E. Wall, L. T. Work, and L. Van Doren. V. F. Kimball was present.

President Flett reviewed briefly some of the activities of the *Institute* during the

year. He reported that he had attended the meeting of the Ohio Chapter when the Ohio Award was made to Dr. M. H. Fischer, and he praised the arrangements made for the plant visit during which an intimate group was shown every courtesy and honor. The award dinner in the evening was characterized by excellent talks.

He announced that the Niagara Chapter's first Honor Award would be made to Dr. E. R. Riegel, whose book on industrial chemistry has been studied by 60,000 chemists.

He praised the *Institute* on its achievement of an all-time high of active membership.

The Council expressed its appreciation for the services which President Flett has rendered during his four years as presiding officer.

Dr. M. J. Kelley was commended for his services in making excellent arrangements for this Annual Meeting and for previous meetings.

The Treasurer's report was presented and accepted.

The Secretary reported that we now have 2,507 active members.

The proposed recommendations to the Civil Service Commission, by the Washington Chapter, were unanimously approved.

The Tellers on Election Ballots announced that the following officers, to take office at the Annual Meeting on May 7th, were elected by a mail vote of the *Institute* members: President-elect, Donald B. Keyes; Secretary, (re-elected), Lloyd Van Doren; Treasurer (re-elected), Frederick A. Hessel; Councilors, Donald Price (re-elected); Charles C. Concannon (re-elected), and John H. Nair.

Incoming President Work asked all committees to continue on an interim basis until the new committees are appointed.

Dr. Kauffmann reported that the Niagara Chapter's first Honor Scroll would be awarded to Dr. Riegel, who retires from the University of Buffalo at the end of this term.

Dr. Egloff discussed the Chicago Chapter's recent meeting on public relations, a subject of great importance to chemists, and which deserves more study.

Mr. Sittenfield announced that the Pennsylvania Chapter is awarding student medals to the colleges in its area, and that at a recent meeting a speaker from Johns Hopkins University talked on "The Chemist Looks At Guided Missiles."

Dr. Kelley announced that the Honor Scroll of the New York Chapter would be awarded to Dr. Foster Dee Snell, May 22nd.

Mr. Gaylor stated that the New Jersey Chapter had enjoyed better attendance at meetings this year by interesting its members in serving on active committees. He announced that the first Honor Scroll of the Chapter would be presented to Dr. Hessel on May 21st, and that at this meeting two outstanding students would be awarded student medals.

Incoming President Work stated that the Institute relies heavily upon assistance from the Chapters and that their activities are extremely important to the Institute's success.

The Secretary was asked to take the chair temporarily while the following motion was made and carried:

Motion: The Council does not want to close this last meeting under Mr. Flett's chairmanship without recording the satisfaction which the members have derived from association with him and from his very efficient and constructive conduct of the affairs of the Institute; as well as from the progress of the Institute which has resulted from his regime. He has left the AIC vastly stronger than when he entered the chair.

The following new members were elected:

FELLOWS

Alessandroni, Hugh V.
Manager of Research, National Lead Company, Titanium Div., Box 58, South Amboy, N. J.

Beckett, James Alfred
Assistant Chemist, Motive Power Dept., Norfolk & Western RRY. Co. (Chem. Lab.) Roanoke 17, Virginia

Brennan, Joseph Harrison
Chief Metallurgist, Electro Metallurgical Co., Niagara Falls, N. Y.

Bronstein, Emanuel H.
Consulting Corrosion Engineer for Research & Sales, The Michigan Pipe Co., Bay City, Mich.

Hall, Robert H.
Associate in Clinical Pharmacology, Pharmaceutical Div., Wallace & Tiernan, Products Inc., Belleville 9, N. J.

Kent, Allen
Staff Member, Division of Industrial Cooperation, Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge 39, Mass.

McCutcheon, John W.
President, John W. McCutcheon Inc., 475 Fifth Ave., New York 17, N. Y.

Webber, Alfred Julian
Technical Sales. Braun Corp., 2260 E. 15th St., Los Angeles 21, Calif.

Wolff, James Seanor
Washington Representative, B. F. Goodrich Chemical Co., 1112 19th St., N. W., Washington 6, D. C.

MEMBER

Berkeley, Bernard
Research Group Leader (Chemical Specialties), Foster D. Snell Inc., 29 West 15th St., New York 11, N. Y.

ASSOCIATES

Block, Charles Seymour
Project Chemical Engineer, Synthetic Detergents Division, Colgate-Palmolive-Peet Co., 105 Hudson St., Jersey City, N. J.

Calkin, Mary Kendrick
Technical Sales Market Research Dept., Foster D. Snell Inc., 29 W. 15th St., New York 11, N. Y.

Ressler, Paul Chrisman Jr.
Sales Trainee, Apparatus Division, Braun Corp., 2260 E. 15th St., Los Angeles, Calif.

Shafiroff, Isidore
Assistant Group Leader (*Chemical Specialties*) Foster D. Snell, Inc., 29 W. 15th St., New York 11, N. Y.

RAISED FROM ASSOCIATE TO FELLOW

Stein, Sidney J.
Assistant Director of Research, International Resistance Co., 401 North Broad St., Philadelphia 8, Pa.

RAISED FROM ASSOCIATE TO MEMBER

Webb, William Paul
Chemist, Chemicals Dept., California Research Corp., Richmond, Calif.

AIC Activities

C. P. Neidig, F.A.I.C.

Annual Report
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Baltimore Chapter

On Wednesday, December 5, 1951, we held a dinner meeting at the Northway Apartments. Our speaker on this occasion was Charles H. McBeth, Professor of Chemistry at Baltimore Junior College. Mr. McBeth gave a very interesting talk on "Microchemistry."

On Thursday, January 10, we held a meeting at Loyola College. On this occasion our speaker was Dr. Charles E. Brambel. Dr. Brambel is an outstanding biochemist, engaged in clinical research work at Mercy Hospital, Baltimore. His subject was "The Chemistry of Blood Clotting."

On Thursday, March 20, we held a meeting at Loyola College, where Dr. John H. Brewer, Director of Bacteriology at Hynson Westcott & Dunning of Baltimore, spoke on "Research in Microbiology."

Our next meeting will be held on Wednesday, May 15. This will be a dinner meeting at the Northway Apartments. Our speaker will be Maurice Siegel, who will speak on "Expert Testimony." This will also be our annual business meeting for the election of officers for the ensuing year.

H. Walter Kuhl
Chairman

Annual Report
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Chicago Chapter

Because of the removal of Bruce Bare, 1950-51 chairman, to Massachusetts in April, 1951, the chairmanship of the Chicao Chapter was assumed ahead of schedule by W. B. Hendrey, chairman-elect for 1951-52.

Officers elected at the final 1950-51 meeting in June were:

Chairman-elect, Bernard S. Friedman
Vice-Chairman, R. F. Davis
Secretary-Treasurer, W .L. Kubie
Councilors (including holdovers)

Mary Alexander
H. S. Block
Gustav Egloff
C. A. Hampel
W. I. Harber
Glen W. Hedrick
H. F. Schwartz

National Councilor, Gustav Egloff

The Chicago Chapter has continued to grow in membership, now numbering about 400 as compared with 373 last year at this time, in spite of an intensive combing of our rolls by the Secretary to remove names of supposed members who had actually moved from the area or dropped their membership in the national society.

Finances have been further strengthened by about a 12-per-cent increase in "balance on hand." Of our members, about 55 per cent of those in the Chicago area have paid their local section dues, while this figure for "outlying" members is about 45 per cent. This is about normal in comparison with past years.

Six general meetings have been held as follows:

1. October 5, 1951, Honor Scroll award to Professor H. I. Schlesinger (This large and successful meeting has been previously well publicized.)
2. November 9, 1951, Talk, "Are You A Chemist?" by Dr. W. C. Krathwahl, Director of Tests, Institute for Psychological Service, Illinois Institute of Technology.
3. February 1, 1952, Award of Honorary Membership to Dr. Ernest Volwiler. Talks: "Utilization of Scientific Personnel" by Dr. Robert Coghill, Dir. of Research, Abbott Laboratories; "Meaning of the AIC Honorary Membership Award," by L. H. Flett, AIC President.
4. April 4, 1952, Talk, "Advancing Yourself in the Chemical Engineering Industry," by Dr. Donald J. Bergman, Chief Engineer, Universal Oil Products Company.
5. May 2, 1952, Talk, "Chemistry and Professional Public Relations," by James C. Leary, Publicist for A.M.A., Chemical Exposition, Etc.
6. June 6, 1952, Annual Business Meeting.

The Chapter maintains two delegates to the Chicago Technical Council, an organization of representatives from various local technical and engineering societies. AIC members have taken on a larger part than ever in this Council. B. S. Friedman is Council President, Clifford Hampel, 2nd Vice President, while Herman S. Bloch, Gustav Egloff, and Edmund C. Field are among the directors. William I. Harber was committee chairman for the Career Conference which conducted a three-day meeting with numerous well-qualified speakers, primarily for career guidance of high school students. Attendance was large and much favorable publicity resulted.

Our Program Chairman, Dr. Barbara Parker, is editor of the Chicago A.C.S. "Chemical Bulletin," which has been generous in its coverage of AIC events.

We are continuing with our Student Award program under the experienced direction of Dr. C. A. Johnson, and this Spring expect to provide 22 student medals.

—W. B. HENDREY
Chairman

Chicago Chapter

The Chicago AIC Chapter held its annual business meeting, June 6th, on the premises of the Western Society of Engineers. All the officers, committee chairmen, etc., submitted reports. Every report was accepted and most of them resulted in more or less vivid discussion.

The first report was that of Mr. Kubie, retiring secretary-treasurer. Noteworthy in his report was the fact that nobody makes use of our Employment Advisory Service.

This service is aparently not known except to those who attend our meetings. This proves clearly that persons not attending the meetings miss something.

The National Council Representative, Dr. Egloff, was next to report. His report led to quite a discussion, followed by a motion that Mr. Herstein, chairman of the New York Chapter, be informed what our Employment Advisory Service is doing. The New York Chapter features tentatively an employment service. Both enterprises could derive mutual benefit by keeping each other informed of their progress.

The report of the Committee on the Economic Status of Chemists was read by the outgoing chairman, Dr. Hendrey.

The report of the House Committee, by Mr. Maguire, followed.

Then came the report concerning Legislation Affecting Chemists, by Dr. Dienner. Here shall be mentioned only HR 7794, clarifying the present patent law, especially what concerns joint ownership of a patent and contributory infringement.

After this, Dr. Coleman reported for the Membership Committee; Miss M. Alexander for the Program Committee; Dr. Field for the Public Relations Committee; and Dr. Johnson for the Student Awards Committee. Next was the report of the Delegate to the Chicago Technical Council, Dr. Friedman.

The outgoing Chairman reported on the AIC Breakfast, held in Milwaukee at the National American Chemical Society meeting, April 1, 1952. Dr. Hedrick reported for the Auditing Committee.

The outgoing Chairman then read the report of the Nominating Committee; this report was followed by the election of the following new officers:

Chairman-elect, H. F. Schwarz
Secretary-Treasurer, W. Jacobson
Vice-Chairman, M. Alexander
National Councilor, Gustav Egloff
Councilors:

H. Bloch (3-year term)
E. Field (3-year term)
H. M. Coleman (3-year term)
R. G. Maguire (3-year term)
W. L. Kubie (2-year term)

After the election we heard the report of the 1952 Testimonial Award Committee by Dr. Schwarz, chairman. This committee was charged with the selection of the recipient of the award.

Washington Chapter

The Chapter met for the election of officers on May 29th, at the Jefferson Hotel, Washington, D. C. Chairman Markwood presided.

The Nominating Committee, under the chairmanship of Frank Wilder, submitted the following slate of officers for the year 1952-53:

Chairman, Milton Harris
Vice-chairman, Paul E. Reichardt
Secretary, Wesley R. Koster
Treasurer, John F. Williams

This slate was elected by unanimous vote.

Some discussion was had concerning the doleful state of the Chapter treasury. In an effort to remove the red figures from the ledger, it was decided to ask the membership for a voluntary contribution of one dollar.

Opportunities

Doris Eager, M.A.I.C.

Chemists Available

Chemial Engineer, F.A.I.C., Licensed Experienced engineering administrator. Six years chief engineer supervising design, construction, maintenance, plus six years production, process development, research. Distillation, fermentation, chemical industries. Age 35. Box 72, THE CHEMIST.

Engineer, M.E., M.S. Age 34. Diversified background in chemistry and engineering sciences. Interested in position with challenge in research and development. Box 70, THE CHEMIST.

Biochemist, F.A.I.C., M.S. degree. Age 37. Fourteen years experience. Prefers Metropolitan N. Y. area. Salary desired $4,000 minimum. Box 74, THE CHEMIST.

Chemist, M.S. 1947. Five years experience: Formulation, evaluation and basic research principally in surface and colloid chemistry, i.e. soap and detergent field. 5 patents pending. Box 76 THE CHEMIST.

Positions Available

Ready-made Opportunity: To step into a going technical sales organization, with present commission income approximately $7,500 per year. Owner wishes to retire with minor interest. Familiarity with paint, resin and rubber latex fields a necessity, travelling in own car a must. Box 71, THE CHEMIST.

Several Chemists: Needed for U. S. Government research project to be undertaken by private engineering firm in Washington-Baltimore area. Send resumes to Box 73, THE CHEMIST.

For Your Library

Radiocarbon Dating

By Willard F. Libby. 1952. The University of Chicago Press. 124 pp. 6¼" x 9". $3.50.

A detailed description of the technique of sampling and measurement of radiocarbon 14. Radiocarbon is formed by the impact of neutrons (derived from the action of cosmic rays) upon nitrogen. The radiocarbon which is formed has a half-life of 5,568 years, decomposing spontaneously to the original nitrogen and a beta particle. The rate of liberation of the beta particle is counted in a special Geiger Counter and the carbon 14 content determined. From the logarithmic rate of decay of Carbon 14, the age of the sample (at fixation) may be determined. Some four-hundred results are given and favorably compared with material of known age The results are most interesting and apparently good to about 11,000 years. Materials older than that are influenced by the glacial period.

The author draws no further conclusion than that the ages of carbon samples are quite true to 14,000 years ago. One suspects that the cosmic ray bombardment during the glacial period was markedly higher than at present, in that the logarithmic law of decay breaks down at low concentrates. The method promises to clarify that period of pre-history when the Paleolithic gave way to the Neolithic and early metal ages. Just as the decay of uranium permitted the dating of geological ages, so radiocarbon permits the dating of cultural development.

—DR. JOHN A. STEFFENS, F.A.I.C.

The New Physics

By Sir C. V. Raman. Philosophical Library, Inc. 1951. 144 *pp.* 5¼" x 8". $3.75.

In spite of the exceedingly distinguished name of its Nobel Prize-winning author, this book is a fraud on the public because its title belies its contents. It contains nineteen chapters, each of which purports to be a radio address by Professor Raman. As radio addresses, they describe physical phenomena in nature and they are naturally cast to the lowest common denominator of audience grasp. From internal evidence it appears very probable that these are unedited shorthand notes of lectures given by Prof. Raman. The subject matter of the nineteen chapters varies over diversified phases of physics and other topics on which Prof Raman enjoys speculation. However, in no case do his speculations state anything which is beyond the comprehension and probably already within the knowledge of an average high school student.

Under the circumstances, the reviewer feels that any educated audience which might, by the impression of Prof. Raman's name, buy the book, would be much disappointed in its contents.

—KARL M. HERSTEIN, F.A.I.C.

Medicinal Chemistry

By Alfred Burger, Vol. II, 1951. Interscience Publishers, Inc. 505 pp. $10.

This volume, containing chapters on hormones, essential animo acids and fatty acids, chemotherapy, theories of metabolite antagonism, sulfonamides, antimalarials, antibiotics, antifungal agents, anthelmintics, etc., is well put together. While the bibliography is not extensive, it is unusually well-chosen, and the book can readily be recommended to those interested in the field.

DR. FREDERICK A. HESSEL, F.A.I.C.

Chemical Books Abroad

Rudolph Seiden, F.A.I.C.

Chapman & Hall Ltd., London WC2: *Animal Nutrition*, by Cyril Tyler, 1950, 216 pp., 15 s. The fundamentals of biochemistry and physiology and their application to animal nutrition are comprehensively treated. The appendix, which presents the structural formulas of the organic compounds and chemical reactions mentioned in the text, is extremely interesting.

Ernst Reinhardt Verlag A. G., Basel: *Allgemeine Metallkunde*, by E. Brandenberger, 1952, 333 pp., 168 ill., paper bound, Sfr. 14. A textbook of the structures and physical properties of metals and alloys; the last chapter is a didactic discourse of chemical reactions on metals.

Heinrich Jakobs Verlag, Rheydt/Rheinland: *Das Glass im chemischen Laboratorium*, by Fritz Friedrichs, 1951, 147 pp., 148 ill. The experiences gained in 40 years of work with the production of glass for chemical laboratories are disclosed here for the benefit of analytical chemists; yet this is not a how-to-do-it book, but a collection of well-illustrated descriptions of the characteristic features, measures, and uses of glass instruments.

The Pharmaceutical Press, London WC1: *Hormones*, 1951, 220 pp., 34 ill., 35 s. Thanks are due the Council of the Pharmaceutical Society of Great Britain for this very excellent survey of the more important endocrine glands and of the natural and artificial hormones. Of special interest are the following chapters: Physiology; Chemistry (of steroid and of non-steroid hormones); Standardization; Action and Uses. A listing of hundreds of commercial preparations and an extensive bibliography conclude this well-written, well-illustrated and well-organized book on a highly diversified subject of steadily growing practical importance. It is unreservedly recommended to all who are interested in hormone chemistry, therapy, or production.

Information

"Specially-prepared Grade of Manganese Dioxide." Eimer & Amend Div., Fisher Scientific Co., New York, N.Y.

"Importance of Volume Relationships in Soil Stabilization." Hans F. Winterkorn & A. N. Dutta Choudhury, Princeton University, Princeton, N. J.

"Taylor Technology." Publication of Taylor Instrument Companies, Rochester 1, New York.

"Aquadag Colloidal Graphite Dispersion Lubricant." Acheson Colloids Corp., Port Huron, Mich.

"Report of the Joint Fire & Marine Insurance Committee on Radiation." 12-p. booklet. National Board of Fire Underwriters, 85 John St., New York. N.Y.

"Control of Radiation Hazards in the Atomic Energy Program." U.S. Atomic Energy Commission, Washington 25, D.C. 55 cents. Supt. of Documents, U.S. Gov. Printing Office, Washington 25, D.C.

"Atomic Attack—A Manual for Survival." $1.00 Culver Products Co., Culver City, Calif.

"Kerotest Needle Valve Folder." Kerotest Manufacturing Co., 2525 Liberty Ave., Pittsburgh 22, Pa.

"Chessie's Territory—Industry's Center of Opportunity." Industrial Development Dept., Chesapeake & Ohio Ry. Co., Terminal Tower, Cleveland 1, Ohio.

"NBS-Meggers Mercury 198 Lamps." Information. Coordinator of Atomic Energy Commission Projects, National Bureau of Standards, Washington 25, D.C.

"Wax S-1167 for improved moisture-proofing." Specifications and samples. Glyco Products Co., Inc., 26 Court St., Brooklyn 2, N.Y.

"Books New & Forthcoming—Science, Medicine, Mathematics." Blackwell's, Broad Street, Oxford, England.

Condensates

Ed. F. Degering, F.A.I.C

Buckman Labs., Inc.

"Who is the happiest man? He who can detect merit in a new acquaintance and rejoice over another's success as if it were his own."

—Goethe

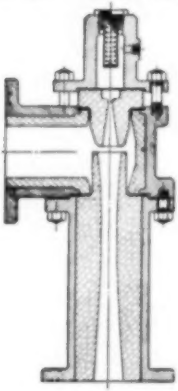
The part which metals play in the predominately organic reactions of biochemistry is only slowly being understood. A comparatively recent theory has shed a good deal of light on this subject. This is the theory of "chelation." The term "chelation" was coined in 1920 by Morgan and Drew for types of structures having an extremely strong tendency to unite with metal ions. The name was derived from the Greek stem *chela*, meaning "claw," to indicate that the metal was held in the pincer-like grip of a ring of atoms.

A new revolutionary process for desalting sea water, announced by E. R. Gilliland, president of Ionics, Inc., gives promise of opening vast new areas of fresh water for use in agriculture, industry, and homes where water is now scarce. The process is based on the use of electrical energy in conjunction with new synthetic membranes that make possible the continuous economical desalting of brackish water, industrial solutions, and sea water.

A new instrument, the scintillation probe, can detect radioactive ores by counting the invisible gamma rays given off by uranium and radium, both faster and more precisely than the commonly used Geiger counter.

When you make a mistake don't look back at it very long. Take the reason of the thing into your mind, and look forward. Mistakes are lessons of wisdom. The past cannot be changed; the future is in our power.

C-R Evactors Meet Corrosion Problems



The chemical industries are employing more and more Croll-Reynolds Evactors in vacuum processes where corrosion resistance is a major consideration. These steam jet vacuum units provide pressures ranging from a few inches to a few microns. Croll-Reynolds is a pioneer in the use of new construction materials and our engineers are investigating corrosion problems continually.

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Consult our engineers for high vacuum equipment carefully designed for your specific conditions, and constructed of materials selected for your particular conditions.

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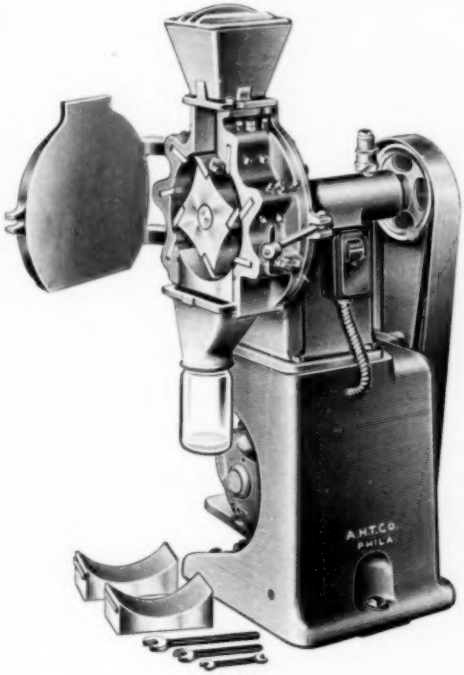
WILEY LABORATORY MILL

Complete with ½ h.p. motor, mounted on pedestal type base



4275-H.

WILEY LABORATORY MILL, Standard Model. Originally designed for the milling of fertilizer materials such as tankage, animal hair, hoofs, etc., but since used with great satisfaction for the preparation, with minimal loss of moisture, of an increasing variety of materials for laboratory analysis.

Four hardened steel knives on a revolving shaft work with a shearing action against six knives bolted into the frame. This shearing action tends to avoid changes in sample such as temperature rise, loss of moisture, liquefaction, contamination, etc., making the Mill satisfactory for many materials which cannot be reduced by other mechanical means. A sieve is dovetailed into the frame so that none of the material comes from the grinding chamber until it can pass through the mesh. Feeding hopper is approx. 38 inches above the floor.

4275-H. **Wiley Laboratory Mill, Standard Model,** as above described, with chute for collecting the sample directly into a screw cap glass jar, on pedestal base, with three sieves of 0.5, 1 and 2 mm mesh, respectively, and ½ h.p. motor with starting box and thermal overload cutout, V-belt and set of wrenches. For 115 volts, 50 or 60 cycles, single phase a.c. **711.50**

4275-R. **Ditto,** but with cast aluminum drawer with rounded inner corners, 28 oz. capacity, which can be withdrawn from the front, for collection of sample in place of chute and glass jars **698.50**

More detailed information sent upon request.

ARTHUR H. THOMAS COMPANY

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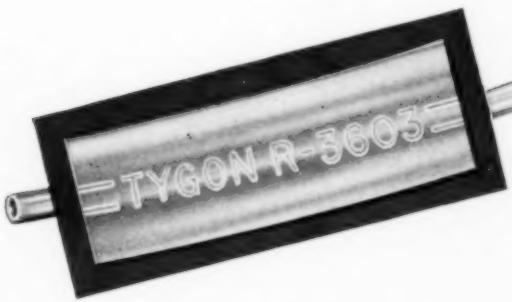

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